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मानक

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Whereas the Parliament of India has set out to provide a practical regime of right to information for citizens to secure access to information under the control of public authorities, in order to promote transparency and accountability in the working of every public authority, and whereas the attached publication of the Bureau of Indian Standards is of particular interest to the public, particularly disadvantaged communities and those engaged in the pursuit of education and knowledge, the attached public safety standard is made available to promote the timely dissemination of this information in an accurate manner to the public.

“जानने का अधिकार, जीने का अधिकार”

Mazdoor Kisan Shakti Sangathan

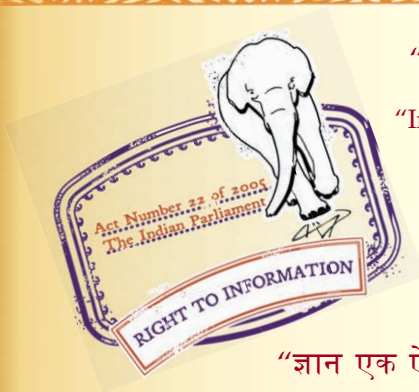
“The Right to Information, The Right to Live”

“पुराने को छोड़ नये के तरफ”

Jawaharlal Nehru

“Step Out From the Old to the New”

IS 15518-1 (2004): Safety Requirements for Incandescent Lamps, Part 1: Tungsten Filament Lamps for Domestic and Similar General Lighting Purposes [ETD 23: Electric Lamps and their Auxiliaries]



“ज्ञान से एक नये भारत का निर्माण”

Satyanarayan Gangaram Pitroda

“Invent a New India Using Knowledge”



“ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है”

Bhartrhari—Nitiśatakam

“Knowledge is such a treasure which cannot be stolen”

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IS 15518 (Part 1) : 2004

भारतीय मानक

ताप-दीप्ति लैम्पों के लिए सुरक्षा अपेक्षाएँ

भाग 1 घरेलू और ऐसे ही सामान्य प्रकाश प्रयोजनों
के लिए टंगस्टन फ़िलामेंट लैम्प

Indian Standard

SAFETY REQUIREMENTS FOR INCANDESCENT LAMPS

**PART 1 TUNGSTEN FILAMENT LAMPS FOR DOMESTIC AND
SIMILAR GENERAL LIGHTING PURPOSES**

ICS 29.140.20

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

August 2004

Price Group 14

FOREWORD

This Indian Standard (Part 1) was adopted by the Bureau of Indian Standards, after the draft finalized by the Electric Lamps and Their Auxiliaries Sectional Committee had been approved by the Electrotechnical Division Council.

This standard covers the safety and interchangeability requirements of tungsten filament incandescent lamps for general lighting services. This standard does not specify the performance requirements, which are covered in a separate standard.

It is intended to prepare following parts of this standard as and when need arises:

Part 2 Tungsten halogen lamps for domestic and similar general lighting purposes

Part 3 Tungsten halogen lamps (non-vehicle) which is presently covered under IS 12948 : 1990 Tungsten halogen lamps (non-vehicle)

This standard is based on IEC 60432-1 (1999) 'Incandescent lamps — safety specifications: Part 1 Tungsten filament lamps for domestic and similar general lighting purposes' issued by the International Electrotechnical Commission (IEC) with the following deviations:

- a) Lamps of E17 and E26 caps have not been covered as these are not in use in India;
- b) Definition on reference lamp, its marking and characteristics have been incorporated; and
- c) Data sheets on caps and their gauges have been included.

The data sheets given in this standard on caps and gauges have been numbered in line with IEC 60061 Lamp caps and holder together with gauges for the control of interchangeability and safety: Part 1 for Lamp caps, and Part 3 for Gauges.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

AMENDMENT NO. 2 FEBRUARY 2008
TO
IS 15518 (PART 1) : 2004 SAFETY REQUIREMENTS
FOR INCANDESCENT LAMPS

PART 1 TUNGSTEN FILAMENT LAMPS FOR DOMESTIC AND
SIMILAR GENERAL LIGHTING PURPOSES

(Page 15, clause D-2.3, line 4) — Substitute 'G-2.3' for 'H-2.3'.

(ET 23)

Reprography Unit, BIS, New Delhi, India

**AMENDMENT NO. 1 DECEMBER 2005
TO
IS 15518 (PART 1) : 2004 SAFETY REQUIREMENTS
FOR INCANDESCENT LAMPS**

**PART 1 TUNGSTEN FILAMENT LAMPS FOR DOMESTIC AND
SIMILAR GENERAL LIGHTING PURPOSES**

(Page 5, clause 4.9, Notes) — Add the following Note 5 after Note 4:

'5 This test shall be applicable from 1 January 2007.'

(Page 11, clause C-2.1.2, second line) — Substitute '0°C' for '0°C - 5°C'.
-5°C

[Page 14, clause D-1.1(c) and (d)] — Substitute 'D-1.4' for 'D-2'.

(Page 57, Data Sheet No. 7006-55, second line) — Substitute 'test' for
'test'.

(ET 23)

Indian Standard

SAFETY REQUIREMENTS FOR INCANDESCENT LAMPS

PART 1 TUNGSTEN FILAMENT LAMPS FOR DOMESTIC AND SIMILAR GENERAL LIGHTING PURPOSES

1 SCOPE

1.1 This standard (Part 1) specifies the safety and interchangeability requirements of tungsten filament incandescent lamps for general lighting service having:

- rated wattage up to and including 200 W;
- rated voltage of 50 V to 250 V inclusive;
- bulbs of the A, B, C, G, M, P, PS, PAR or R shapes (*see Note*), or other bulb shapes where the lamps are intended to serve the same purpose as lamps with the foregoing bulb shapes;
- bulbs with all kinds of finishes;
- caps B15d, B22d, E12, E14, E27 or E27/51 × 39.

NOTE — *See IS 14897 for description of the letter symbols. Associated traditional names are:*

- Pear shape = A, PS
- Mushroom = M
- Candle = B, C
- Round bulb = P
- Globular = G
- Reflector = R
- Parabolic reflector = PAR

As far as is reasonably practicable, this standard is also applicable to lamps with bulbs and caps other than those mentioned above, but which serve the same purpose.

This standard specifies the method a manufacturer should use to show, that his product conforms to this standard, on the basis of whole production appraisal in association with his test records on finished products. This method can also be applied for certification purposes. Details of a batch test procedure, which can be used to make limited assessment of batches, are also given.

This standard is concerned with safety criteria only and does not take into account the performance of tungsten filament lamps with respect to luminous flux, life or power consumption characteristics. Readers should refer to IS 418 for such characteristics with respect to types normally used for general lighting service.

2 REFERENCES

2.1 The following standards are necessary adjuncts to this standard:

<i>IS No.</i>	<i>Title</i>
418 : 2004	Tungsten filament lamps for domestic and similar general lighting purposes (<i>fourth revision</i>)
2500 (Part 1) : 2000	Sampling inspection procedures Part 1: Attribute sampling plans indexed by acceptable quality level (AQL) for lot-by-lot inspection (<i>third revision</i>)
8913 : 1978	Method of measurement of lamp cap temperature rise
10276 (all parts)	Edison screw lamp holders
12948 : 1990	Tungsten halogen lamps (non-vehicles)
10322 (Part 1) : 1982	Luminaries : Part 1 General requirements
14897 : 2000	Glass bulb designation system for lamps—Guide

3 TERMINOLOGY

For the purpose of this standard, following definitions shall apply.

3.1 Category — All lamps of one manufacturer having the same general construction (bulb shape, external dimensions, cap type, filament type), rated voltage, rated wattage and finish.

For the purposes of this standard:

- a) clear, frosted and coatings equivalent to a frosted finish are considered to be the same;
- b) various coloured and white finishes are not considered to be the same.

NOTE — Lamps differing only by their caps (for example, E27 and B22d) are of different 'categories', but of the same 'type' as defined in IS 418.

3.2 Type — Lamps, which, independent of the type of cap are identical in photometric and electrical characteristics.

3.3 Class — All lamps having the same general construction (bulb shape, external dimensions, cap type, filament type), rated wattage and finish and differing only by their rated voltages, when these voltages fall within the same voltage range (for example, 100 V to 150 V, 200 V to 250 V).

3.4 Rated Voltage — Voltage or voltage range specified in the relevant lamp standard or assigned by the manufacturer or responsible vendor. (If lamps are marked with a voltage range, it shall be interpreted that they are appropriate for use on any supply voltage within that range.)

3.5 Test Voltage — Rated voltage unless otherwise specified. (If lamps are marked with a voltage range, the test voltage shall be taken as the mean of the voltage range unless otherwise specified.)

3.6 Rated Wattage — Wattage specified in the relevant lamp standard or assigned by the manufacturer or responsible vendor.

3.7 End of Life — Instant when the energized lamp ceases to emit light.

3.8 Cap Temperature Rise (Δt_c) — Surface temperature rise, above ambient temperature, of a standard test lampholder fitted to the lamp's cap, when measured in accordance with the standard method described in IS 8913.

3.9 Design Test — Test made on a sample, for the purposes of checking compliance of the design of a category, class or group of categories with the requirements of the relevant clause.

3.10 Periodic Test — Test repeated at intervals in order to check that the product does not deviate in certain respects from the given design.

3.11 Running Test — Test applied at frequent intervals in order to provide data for assessment.

3.12 Batch — All the lamps of one category, identified as such, and put forward at one time for checking compliance.

3.13 Whole Production — Production of all types of lamps within the scope of this standard manufactured during a period of 12 months in a list for inclusion in the control, this list being incorporated in the certificate when certification is in operation.

3.14 Bowl Mirror Lamp — Lamp with part of its bulb coated with reflecting material so as to reflect a substantial part of the light in the general direction of the lamp cap.

3.15 Maximum Cap Temperature — Maximum temperature, which the components in the cap area of a lamp are designed to withstand over the expected life of the lamp.

3.16 Lamp Neck Reference Diameter — That diameter of a lamp which is of influence on the protection against accidental contact and which is measured at a defined distance from the solder contact plate.

For E14 capped lamps, this distance is 30 mm.

4 REQUIREMENTS

4.1 General

Lamps shall be so designed and constructed that in normal use they present no danger to the user or surroundings.

Lamps shall satisfy the requirements of this clause.

4.2 Marking

4.2.1 Mandatory Markings

The following information shall be marked on the lamps and shall be legible and durable when subjected to the test procedure given in A-1:

- mark of origin (this may take the form of a trade-mark, the manufacturer's name or the name of responsible vendor);
- the rated voltage or the rated voltage range, marked as 'V' or 'volts';
- the rated wattage, marked as 'W' or 'watts'; and
- Country of manufacture.

For lamps with 40 mm diameter bulbs or larger and with a realized wattage of 14 W or less, the wattage need not be marked.

NOTE — The implementation of 230 V harmonization process allows supply voltages to remain at 240 V and 250 V.

4.2.2 The lamps may also be marked with Standard Mark.

4.2.2.1 The use of the Standard Mark is governed by the provisions of *Bureau of Indian Standards Act, 1986* and the Rules and Regulations made thereunder. The details of conditions under which the licence for the use of the Standard Mark may be granted to the manufacturers or producers may be obtained from the Bureau of Indian Standards.

4.2.3 Dichroic Reflectorized (Cool Beam) Lamps and Bowl Mirror Lamps

The immediate lamp wrapping or container shall be marked with the relevant symbol as shown in Annex B.

4.2.4 Lamps with Operating Positions Limitations

For lamps requiring operating position limitations, such as, some 60 W candle and round bulb lamps capped with B22d or E27 caps, which can comply with the requirement of the lamp cap temperature rise only by excluding the cap-up position, the intermediate lamp wrapping or container shall be marked with the appropriate symbol. An example is shown in Annex B.

NOTE — The requirements given in 4.2.2 and 4.2.3 are intended as information for the end-user of the lamp.

4.3 Protection Against Accidental Contact in Screw Lampholders

Dimensions of screw-capped lamps shall be such that safety against accidental contact is ensured according to relevant data sheets.

The lamps shall satisfy the gauges in accordance with Table 1.

Table 1 Gauges for Checking Lamps for Protection Against Accidental Contact
(Clause 4.3)

Lamp Cap	Gauge	Lamp Cap	Gauge
E12	—	E27/25 and E27/27	see Data Sheet 7006-51A
E14	see 4.3.1	E27/51× 39	see Data Sheet 7006-51
NOTE — The dash marking in the gauge column means that at the moment no such test system has been developed.			

4.3.1 E14 Capped Lamps

E14 capped lamps shall satisfy the following requirements:

- a) Candle lamps shall be fitted with caps E14/25 × 17 and tested with gauge 7006-55.
- b) Round bulb, pigmy, tubular and reflector lamps having lamp neck reference diameters of 21 mm and greater shall be fitted with caps E14/25×17 and tested with gauge 7006-55.
- c) Round bulb, pigmy, tubular and reflector lamps having lamp neck diameters between 16 mm and 21 mm shall be fitted with caps E14/23×15 or E14/20.
- d) Round bulb, pigmy, tubular and reflector lamps having lamp neck reference diameters between 14 mm and 16 mm shall be fitted with caps E14/20.

In cases (c) and (d), a gauge is not required, because the choice of caps guarantees the same degree of safety as in cases (a) and (b).

4.4 Lamp Cap Temperature Rise (Δt_f)

4.4.1 Average Cap Temperature Rise

The average cap temperature rise per class of lamp manufactured in a period of 12 months shall not exceed the following:

- a) The appropriate value as specified in Table 2; or
- b) 45 K lower than the relevant values given in Table 2 where advantage is taken of the lower maximum cap temperature of 4.5.4 (b).

However, lamps fitted with E12 caps with higher Δt_f values intended for special applications are permitted, provided suitable cautionary notices accompany each lamp.

4.4.2 Compliance

Compliance shall be checked by measurements of lamp cap temperature rise on lamps in the same class in accordance with the test procedure specified in IS 8913.

If the lamp is marked with a voltage range, the cap temperature rise shall be measured at the mean voltage provided the limits of the voltage range do not differ by more than 2.5 percent from the mean voltage. For lamps with a wider voltage range, the measurement shall be at the highest marked voltage.

NOTE — Table 2 shows upper limits for average cap temperature rise, which apply to all lamps listed by wattage, bulb and cap. In practice, several design features, such as, light centre length, mount shape and bulb finish affect cap temperature rise, but such factors are encompassed in each limit.

4.4.3 Batch Testing

For the testing of batches when the 20-lamp sample size is needed, the average shall not exceed the appropriate value in accordance with 4.4.1, with an allowance of +9 K.

4.5 Resistance to Torque

4.5.1 Caps

Caps shall be so constructed and assembled to the bulbs that they remain attached during normal operation.

4.5.2 Unused Lamps

For unused lamps, the lamp cap shall not move relative to the bulb when subjected to the relevant torque value from Table 3 as tested in accordance with C-1. Where the means of attachment is other than by capping cement or adhesive, relative movement between bulb and cap is permitted, provided it does not exceed 10°.

4.5.3 Resistance to Heat

The lamp cap and capping cement or other means of attachment shall endure exposure to heat at a level equal to the maximum cap temperature for which that class of lamp is designed.

The lamp cap shall not move relative to the bulb when subjected to the relevant torque values of Table 4 after the heating test specified in C-2 at the appropriate temperature of 4.5.4. In the case where the means of attachment is other than by capping cement or adhesive, relative movement between bulb and cap is permitted, provided it does not exceed 10°.

Table 2 Maximum Allowable Cap Temperature Rise (Δt_c) for Various Lamp Wattages and Classes Over a 12-Month Period Average
(Clauses 4.4.1 and 4.4.2)

Group Number	Wattage (Note 1)	Bulb Shape	Δt_c Max				
			B15d	B22d	E12	E14	E27
1	25 and 30 40 60 100 150 and 200	A, PS, M and other shapes intended for use in the same luminaire	—	—	—	—	—
			—	—	—	—	—
			—	125	—	—	120
			—	135	—	—	130
			—	135	—	—	130
2	40 60	B, G (equal to or less than 45 mm diameter), P and other shapes intended for use in the same luminaire	135 145	140 125 (Note 3)	— —	130 140	140 120 (Note 3)
3	15 25 40 60	C and other shapes intended for use in the same luminaire	—	—	90 (Note 2)	—	—
			—	—	110 (Note 5)	—	—
			—	—	130 (Note 5)	—	—
			—	—	145 (Note 5)	—	—
			—	—	—	—	—
4	25 and 40 60 and 100	G (> 45 mm diameter)	— —	— —	— —	— —	— —
5	25 40 60	P and G (\leq 45 mm diameter with bowl mirror)	— 135 135	— 135 —	— — —	— 135 135	— 135 —
6	60 100 150 and 200	A and PS with bowl mirror	— — —	130 135 135	— — —	— — —	130 135 135
7	25 40 60 100, 150 and 200	R shapes	— 120 — —	— 120 130 135	— — — —	— 120 — —	— 120 130 135
8	75 100 150	PAR shapes (Note 4)	— — —	— — —	— — —	— — —	150 150 150
9	150	PAR shapes with dichroic reflector (Note 4)	—	—	—	—	175
NOTES 1 For lamps with intermediate wattage values, the requirement of the next higher value shown applies. 2 Under consideration. 3 This may require a limitation on operating position, 4 Lamps with skirted caps: E27/51×39. 5 Some lamp classes may be limited to operation in the cap-down or cap-down-through-horizontal positions by the manufacturer.							

4.5.4 Heating Treatment Temperatures

The heating treatment shall be conducted at one of the following levels:

- a) The maximum cap temperature, in relation to cap type as specified in Table J-1; or
- b) For certain classes of lamps where 210°C is

specified in Table J-1, the manufacturer may elect to design lamps that can withstand a maximum cap temperature of 165°C, in which case the heating test is carried out at 165°C, provided their rated wattage is 15 W or lower, and the lamp is not a reflector or bowl mirror type.

Table 3 Torque Test Values for Unused Lamps
(Clause 4.5.2)

Cap Type	Torque Value Nm
B15d	1.15
B22d	3.0
E12	0.8
E14	1.15
E27 and E27/51x39	3.0

Table 4 Torque Test Values After Heating
(Clause 4.5.3)

Cap Type	Torque Value Nm
B15d	0.3
B22d	0.75
E12	0.5
E14	1.0

4.6 Insulation Resistance of B15d, B22d and E27/51 × 39 Capped Lamps and Other Lamps having Insulated Skirts

Insulation resistance between the shell of the cap and the contacts of bayonet capped lamps, or between the shell and the insulated skirt of skirted Edison screw capped lamps, shall be not less than 2 MΩ when measured in accordance with the procedure of A-3.

4.7 Accidentally Live Parts

4.7.1 Metal Parts Intended to be Insulated from Live Parts

Metal parts intended to be insulated from live parts shall not be or become live. Any moveable conductive material shall be placed without the use of a tool, in the most onerous position before inspection in accordance with A-4.

4.7.2 Bayonet Caps

On bayonet caps, any projection from the contact plate shall not come within 1 mm of metal parts intended to be insulated.

4.7.3 Edison Screw Caps

On Edison screw caps any projection from the cap shell shall not project more than 3 mm from the surface of the cap (see Fig. 1).

4.8 Creepage Distances for B15d and B22d Capped Lamps

The minimum creepage distance between the metal shell of the cap and the contacts shall be in accordance with the distance given in relevant data sheets.

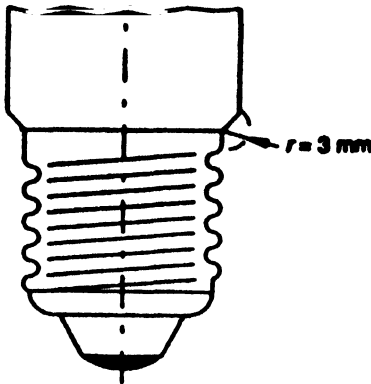


FIG. 1 EDISON SCREW CAP

4.9 Safety at End of Life

When tested under the specified conditions, lamp failure shall not be accompanied by breakage of the outer glass envelope nor its ejection from the cap. For bayonet capped lamps, it is also required that there shall not be an internal short-circuit to the cap shell after the test.

The test conditions are:

- an induced-failure test in accordance with Annex D, and
- an operation-to-failure test in accordance with Annex E.

NOTES

- 1 Tests of Annexes D and E are the reference methods.
- 2 The induced-failure test is not suitable for lamps with rated voltages below 100 V.
- 3 If lamps fail the induced-failure test, it is not necessary for them to be submitted to the operation-to failure test.
- 4 Under circumstances defined in G-3, the operation-to-failure test may be used in place of the induced-failure test.

4.10 Interchangeability

Interchangeability shall be ensured by the use of caps that are in accordance with the relevant data sheets as follows:

Cap Type	Cap Data Sheet
B22d	7004-10
B15d	7004-11
E27	7004-21
E14	7004-23
E27/51 × 39	7004-27
E12	7004-28

Finished lamps shall satisfy the gauges for checking

the dimensions controlling interchangeability in accordance with Table 5.

4.11 Information for Luminaire Design

Refer to Annex J.

5 ASSESSMENT

5.1 General

This clause specifies the method a manufacturer shall use to show that his product conforms to this standard on the basis of whole production assessment in association with his test records on finished products. This method can also be applied for certification purposes. Clause 5.2, 5.3 and 5.5 give details of assessment by means of the manufacturer's records.

Details of a batch test procedure, which can be used to make limited assessment of batches, are given in 5.4 and 5.6. Requirements for batch testing are included in order to enable the assessment of batches presumed to contain unsafe lamps. As some safety requirements cannot be checked by batch testing and as there may be no previous knowledge of the manufacturer's quality, batch testing cannot be used for certification purposes nor in any way for an approval of the batch. Where a batch is found to be acceptable, a testing agency may only conclude that there is no reason to reject the batch on safety grounds.

5.2 Whole Production Assessment by Means of the Manufacturer's Records

5.2.1 The manufacturer shall show evidence that his products comply with the particular requirements of 5.3. To this end, the manufacturer shall make available all the results of his product testing pertinent to the requirements of this standard.

5.2.2 The test results may be drawn from working records and as such may not be immediately available in collated form.

5.2.3 The assessment shall be based on the acceptance criteria of 5.3. For certification purposes, the certification authority shall have the right to visit the plant to examine the relevant local records and quality control procedures.

5.2.4 For certification purposes, the manufacturer shall declare a list of lamp categories or classes, which are within the scope of this standard. The certificate shall be taken to include all lamps so listed made by the manufacturer. Notification of additions or deletions may be made at any time.

5.2.5 In presenting the test results, the manufacturer may combine results of different lamp classes according to col 4 of Table 6.

The whole production assessment requires that the quality control procedures of a manufacturer shall satisfy recognized quality system requirements for final inspection. Within the framework of a quality assurance system based also on in-process inspection and testing the manufacturer may show compliance with some of the requirements of this standard by means of in-process inspection instead of finished product testing.

5.2.6 The manufacturer shall provide sufficient test records with respect to each clause as indicated in col 5 of Table 6.

5.2.7 The number of non-conformities in the manufacturer's records shall not exceed the limits shown in Annex F relevant to the Acceptable Quality Level (AQL) values shown in col 6 of Table 6.

Table 5 Interchangeability Gauges and Lamp Cap Dimensions
(Clause 4.10)

Lamp Cap	Cap Dimensions to be Checked by the Gauges	Data Sheet
B15d, B22d	A, Min A Max, D1 Max, N Min Insertion of the cap in the lampholder Retention of the cap in the lampholder	7006-10 7006-11 7006-4A 7006-4B
E12	Maximum diameter of screw threads Additional 'Go' gauge for screw thread Minimum major diameter of the cap screw threads	7006-27H 7006-27J 7006-28C
E14	Maximum dimensions of screw thread Minimum major diameter of screw threads Dimension S ₁	7006-27F 7006-28B 7006-27G
E27	Maximum dimensions of screw thread Minimum major diameter of screw threads Dimension S ₁	7006-27B 7006-28A 7006-27C

5.2.8 The period of review for assessment purposes need not be limited to a predetermined year, but may consist of 12 consecutive calendar months immediately preceding the date of review.

5.2.9 A manufacturer who has met, but no longer meets the specified criteria, shall not be disqualified from claiming compliance with this standard providing he can show that:

- a) action has been taken to remedy the situation as soon as the trend was reasonably confirmed from his test records;
- b) the specified acceptance level was re-established within a period of:
 - six months for 4.4.1, 4.5.3 and 4.9;
 - one month for other clauses.

Table 6 Grouping of Test Records, Sampling and Acceptable Quality Levels (AQL)
(Clauses 5.2.5, 5.2.6, 5.2.7, 5.2.11, 5.3.1 and 5.5.1)

Clause	Tests	Type of Test	Group of Test Records Between Lamp Classes	Minimum Annual Sampling per Grouping		AQL ¹⁾ %
				For Lamps Made Most of the Year	For Lamps Made Infrequently	
(1)	(2)	(3)	(4)	(5)		(6)
4.2.1	Marking	Running	All classes with same method of marking	200	—	2.5
	Legibility	Running	All classes with same method of marking	200	—	2.5
4.2.1 and 4.2.4	Marking Durability					
4.2.1 and 4.2.4	Presence of required symbol	Running	All classes with same method of marking	—	32	2.5
4.3	Accidental contact	Running	All lamps tested with their appropriate gauge	200	32	1.5
4.4	Cap temperature rise	Design or periodic ⁴⁾	Lamps by class	5 at any design change	20	—
4.5.2	Resistance to torque Unused lamps Test by attributes according to C-1.4	Running	All lamps with the same cement and the same cap	200	80	0.65
4.5.3	After heating Test by attributes according to C-2.3	Periodic ²⁾	All lamps with the same cement and the same cap	125	80	0.65
4.6	Insulation resistance	Running	All classes with B15d, B22d and E27/51 × 39 caps	315		0.4
4.7	Accidentally live parts	100 percent by inspection	—	—		—
4.8	Creepage distances	Design	a) All lamps with B15d caps b) All lamps with B22d caps	5 or 10 at design change ³⁾ 5 or 10 at design change ³⁾		
4.9	Induced failure Operation to failure	Design Periodic	See G-1 All lamps of all classes	G-2 315		G-4 0.25
4.10	Interchangeability	Periodic	All classes with the same cap	32		2.5

¹⁾ Use of this term and Table F-1 is as put forth in IS 2500 (Part 1) where operating characteristics can be found.
²⁾ For lamps with uncemented caps, this shall be a design test.
³⁾ See 5.3.4.
⁴⁾ See 5.3.3.

When compliance is assessed after corrective action has been taken in accordance with items (a) and (b), the test records of these lamp categories which do not comply shall be excluded from the 12-month summation for their period of non-compliance. The test results relating to the period of corrective action shall be retained in the records.

5.2.10 A manufacturer who has failed to meet the requirements of a clause where grouping of the test results is permitted under 5.2.5 shall not be disqualified for the whole of the lamp classes so grouped if he can show by additional testing that the problem is present only in certain classes so grouped. In this case, either these classes are dealt with in accordance with 5.2.9 or they are deleted from the list of classes which the manufacturer may claim are in conformity with the standard.

5.2.11 In the case of a category or class which has been deleted under 5.2.10 from the list (*see* 5.2.4), it may be reinstated if satisfactory results are obtained from tests on a number of lamps equivalent to the minimum annual sample specified in Table 6, required by the clause where non-compliance occurred. This sample may be collected over a short period of time.

5.2.12 In the case of new products, there may be features, which are common to existing lamp classes, and these can be taken as being in compliance if the new product is taken into the sampling scheme as soon as manufacture is started. Any feature not so covered shall be tested before production starts.

5.3 Assessment of the Manufacturer's Records of Particular Tests

5.3.1 Table 6 specifies the type of test and other information, which applies to the method of assessing compliance to the requirements of various clauses. For some particular tests, more detailed information is given below.

A design test need only be repeated when a substantial change is made in the physical or mechanical construction, materials, or manufacturing process used to manufacture the relevant product. Tests are required for only those properties affected by the change.

5.3.2 With regard to the resistance to torque after the heating requirements of 4.5.3, the manufacturer has to follow test procedure, as set out in Annex C.

5.3.3 With regard to the cap temperature rise requirements of 4.4, the manufacturer's records shall show either:

- design test, if the cap temperature rise of each lamp in the samples of five is at least 5 K below the value of Table 2; or

- the results of periodic testing, where the average shall not exceed the value of Table 2.

Where assessment is made for a lesser period than the full 12 months, a coefficient of variation of 5 percent shall be assumed in making the assessment.

5.3.4 Creepage distance is assessed as a design test. If all five lamps of the sample meet the requirements of 4.8, the test is passed. A non-conformity is recorded if two or more lamps fail. If one lamp fails, a further sample of five is to be taken and if no further lamps fail, the test is passed.

5.4 Rejection Conditions of Batches

5.4.1 With the exception of the cap temperature rise test, which is covered by 5.4.2, rejection is established if any rejection number in Table 7 is reached. Irrespective of the quantity tested, a batch shall be rejected as soon as the rejection number for a particular test is reached.

5.4.2 For the batch test of lamp cap temperature rise, five lamps shall be first tested. Provided that all the lamps have a cap temperature rise at least 5 K lower than the appropriate values shown in Table 2, then no further testing for cap temperature rise is necessary. If at least one of the five lamps in the test has a cap temperature rise within 5 K of the appropriate value shown in Table 2, then a total of 20 lamps shall be tested and the average temperature shall not exceed the requirements of 4.4.2.

5.5 Sampling Procedures for Whole Production Testing

5.5.1 The conditions of Table 6 apply.

5.5.2 The whole production running tests shall be applied at least once per production day. They may also be based on in-process inspection and testing.

The frequency of application of the various tests may be different, providing the conditions of Table 6 are met.

5.5.3 Whole production tests shall be made on samples randomly selected at a rate not less than that indicated in col 5 of Table 6. Lamps selected for one test need not be used for other tests.

5.5.4 For whole production testing of the requirements for accidentally live parts, (*see* 4.7), the manufacturer shall demonstrate that there is a continuous 100 percent inspection.

5.5.5 In relation to the safety at end of life (*see* 4.9), the manufacturer shall have a sampling plan which does not deliberately exclude any of the classes in his nominated list.

5.6 Sampling Procedures for Batch Testing

5.6.1 The lamps for testing shall be selected in accordance with a mutually agreed method so as to ensure proper representation. Selection shall be randomly made as nearly as possible from one-third of the total number of containers in the batch, with a minimum of ten containers.

5.6.2 In order to cover the risk of accidental breakage, a certain number of lamps in addition to the test quantity shall be selected. These lamps shall only be substituted for lamps of the test quantities if necessary to make up the required quantities of lamps for the tests.

It is not necessary to replace an accidentally broken

lamp if the results of the test are not affected by its replacement, provided the required quantity of lamps for the following test is available. If replaced, such a broken lamp shall be neglected in calculating the test results.

Lamps having broken bulbs when removed from the packaging after transit shall not be included in the test.

5.6.3 Number of Lamps in the Batch Sample

There shall be at least 500 lamps (*see* Table 7).

5.6.4 Sequence of the Tests

The testing shall be carried out in the most convenient sequence of clause numbers listed in Table 7.

Table 7 Batch Sample Size and Rejection Number
(Clauses 5.4.1, 5.6.3 and 5.6.4)

Clause	Test	Number of Lamps Tested	Rejection Number
4.2.1	Marking legibility	200	11
4.2.1	Marking durability	200	11
4.2.2	Presence of required symbol	200	11
4.3	Accidental contact (Edison screw caps)	200	8
4.4	Cap temperature rise	See 5.4.2	—
4.5.2	Resistance to torque (unused lamps)	125	3
4.5.3	Resistance to torque (after heating)	125	3
4.6	Insulation resistance	500	6
4.7	Accidentally live parts	500	1
4.8	Creepage distance B15d or B22d capped lamps	See 5.3.4	—
4.9	End of life	200	2
4.10	Interchangeability	200	11

ANNEX A

(Clauses 4.2.1, 4.6 and 4.7.1)

MISCELLANEOUS TEST PROCEDURES

A-1 MARKING

A-1.1 The presence and legibility of the marking is checked by visual inspection.

A-1.2 The durability of the marking is checked by applying the following test on unused lamps.

The area of the marking shall be rubbed by hand with a smooth cloth dampened with water for a period of 15 s.

A-1.3 The presence of the proper marking on the immediate lamp wrapping or container is checked by visual inspection.

A-2 USE OF CAP GAUGES

The procedure is specified in relevant data sheets.

A-3 INSULATION RESISTANCE

A-3.1 Insulation resistance measurements shall be carried out with suitable test equipment using a d.c. voltage of 500 V.

A-3.2 Measurements are made on finished lamps. The lamps, if necessary, shall be aged at their rated voltage for 1 h.

A-4 PROJECTING METAL PARTS

The presence of metal parts projecting outside the limits of 4.7 shall be checked by either an appropriate automatic system or by visual inspection. In addition, there shall be regular daily checks of the equipment or verification of the effectiveness of the inspection.

ANNEX B

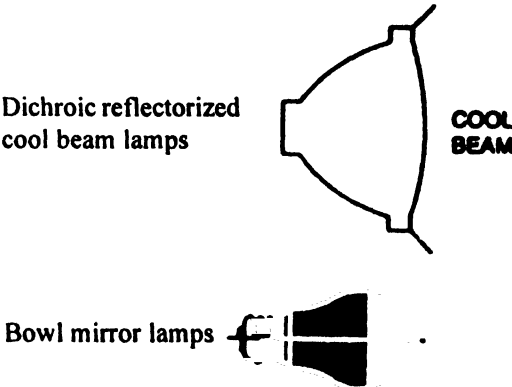
(Clauses 4.2.3 and 4.2.4)

PACKAGING MARKING SYMBOLS

B-0 The height of the graphical symbols shown below shall be not less than 5 mm, and for letters, not less than 2 mm on the lamp package.

B-1 DICHROIC REFLECTORIZED COOL BEAM LAMPS AND BOWL MIRROR LAMPS

These symbols are to safeguard against the use of the lamps in unsuitable luminaire installations where overheating could occur. Such luminaires are also required to be marked with a symbol as given below:



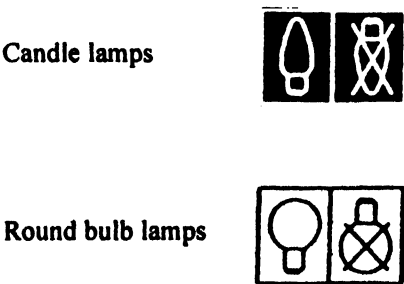
NOTE — The cap shown in the symbol may be bayonet or Edison screw. The bulb shape may be varied to show the shape of the lamp.

B-2 LAMPS WITH OPERATING POSITION LIMITATIONS

These symbols are to indicate that only cap-down to horizontal operation is permitted because of possible overheating.

There shall be text in the vicinity of the symbol, to avoid it being read upside down.

The symbols for candle and round bulb lamps are given as examples.



ANNEX C

(Clauses 4.5.2 and 4.5.3)

RESISTANCE TO TORQUE TEST PROCEDURES

C-1 RESISTANCE TO TORQUE (UNUSED LAMPS)

C-1.1 Details for torque test holders are shown in Fig. C-1 for B15 and B22 caps and in Fig. C-2 for E12, E14 and E27 caps.

C-1.2 Before each use, the test holder for screw caps shall be checked to ensure that it is clean and completely free of lubricants and grease.

C-1.3 The cap of the test lamp shall be placed in the appropriate holder. Either the cap or the bulb may be mechanically clamped.

C-1.4 Torque shall be applied steadily to the appropriate lamp component, so that no jerk occurs. The application of the torque shall be according to the limits given in Table 3.

C-2 RESISTANCE TO TORQUE FOLLOWING HEATING

C-2.1 Lamps shall be placed in an oven.

C-2.1.1 The required temperature as given in 4.5.4 shall be maintained throughout the working space where the lamps are placed.

C-2.1.2 The oven shall be maintained within a temperature tolerance of 0°C – 5°C.

C-2.1.3 The test lamps shall be heated continuously for a period of 1.5 times the lamp life declared by the manufacturer.

C-2.2 Upon completion of the specified period, the lamps are allowed to cool to room temperature.

C-2.3 Measurement of Resistance to Torque

Follow the procedures of C-1.1 to C-1.4. However the required torque as given in Table 4 shall be applied.

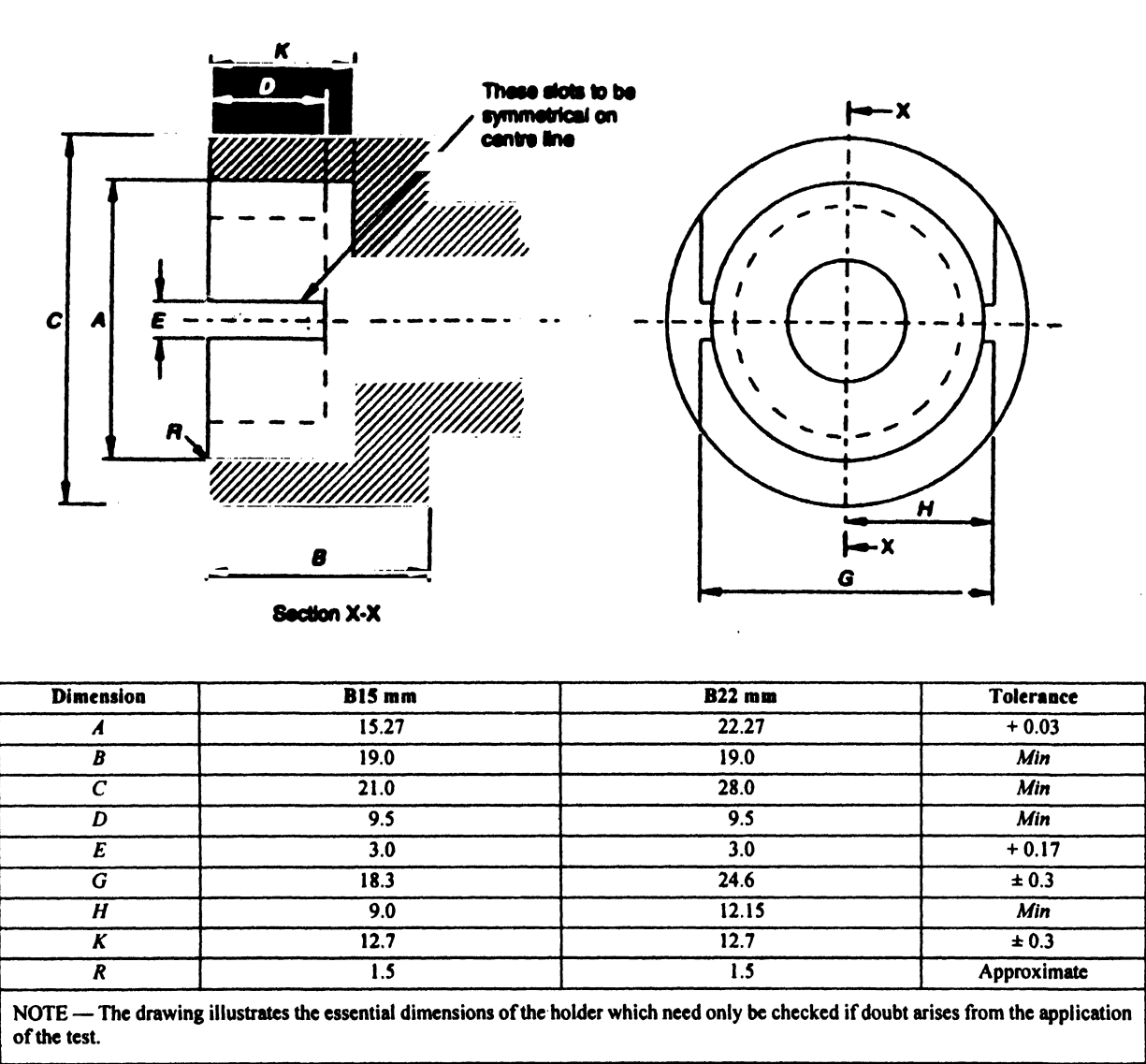
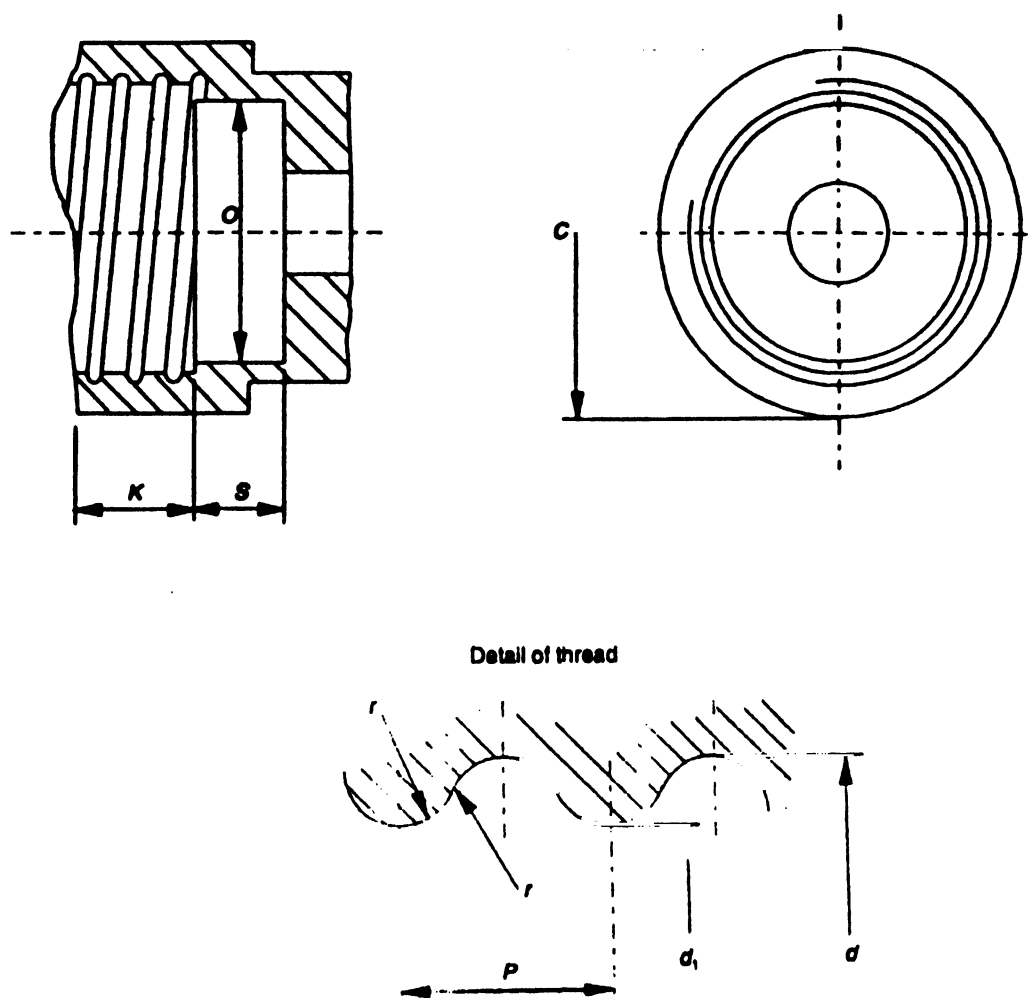


FIG. C-1 HOLDER FOR TORQUE TEST ON LAMPS WITH BAYONET CAPS



Surface finish of screw thread $R_a = 0.4 \mu\text{m}$, *Min* (see Note).

NOTE — A smoother surface might result in mechanical overloading of the cap, *see also* C-1.2

Dimensions in millimetres.

Dimension	E12	E14	E27	Tolerance
C	15.27	20.0	32.0	<i>Min</i>
K	9.0	11.5	13.5	0.0 – 0.3
O	9.5	12.0	23.0	+0.1 – 0.1
S	4.0	7.0	12.0	<i>Min</i>
d	11.89	13.89	26.45	+0.1 0.0
d_1	10.62	12.29	24.26	+0.1 0.0
P	2.540	2.882	3.629	—
r	0.792	0.822	1.025	—

NOTE — The drawing illustrates the essential dimensions of the holder which need only be checked if doubt arises from the application of the test.

FIG. C-2 HOLDER FOR TORQUE TEST ON LAMPS WITH SCREW CAPS

ANNEX D

(Clause 4.9)

INDUCED-FAILURE TEST

D-1 TEST CIRCUIT AND EQUIPMENT

D-1.1 The test circuit shown in Fig. D-1 shall consist of the following:

- a) A 50 Hz mains supply line whose voltage shall be the rated voltage of the lamps, within a -2 percent tolerance. The test voltage of a lamp with a voltage range marking shall be that voltage which is halfway between the range limits;
- b) Switch *S*;
- c) Inductance *L* to bring the total inductance to the value specified in D-2;
- d) Resistor *R* to bring the total resistance to the values specified in D-2;
- e) Lampholder *H* which for B15 and B22 capped lamps shall have an earthed shell; and
- f) Fuse *F* with a rating not less than 25 A, for 220 V – 250 V lamps. For 100V – 150 V lamps, 15 A (*under consideration*).

D-1.2 A safety cover shall be provided to cover the lamp in the test position.

D-1.3 The pulse generator shall be capable of giving a pulse, which meets the following characteristics, as measured across the test lamp (*see* Fig. D.2 and D-3):

- peak value (kV): 2.9 to 3.1 for lamps with a rated wattage up to and including 100 W;
2.4 to 3.1 for lamps with a rated wattage higher than 100 W;
- width t_w (at 40 percent of peak value) (μ s): 8 to 20 for lamps with a rated wattage up to and including 100 W;
10 maximum for lamps with a rated wattage higher than 100 W;
- rise time t_r (μ s): 1 maximum;
- timing $\phi = 70^\circ \pm 10^\circ$ (electrical degrees)

NOTE — The peak value is measured from the zero voltage level (*see* Fig. D-3).

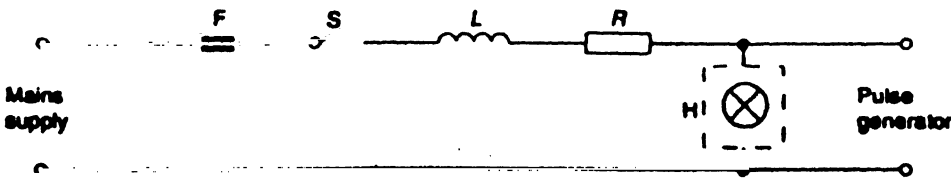


FIG. D-1

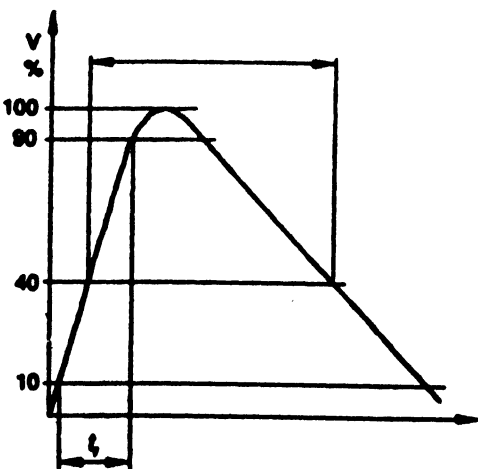


FIG. D-2

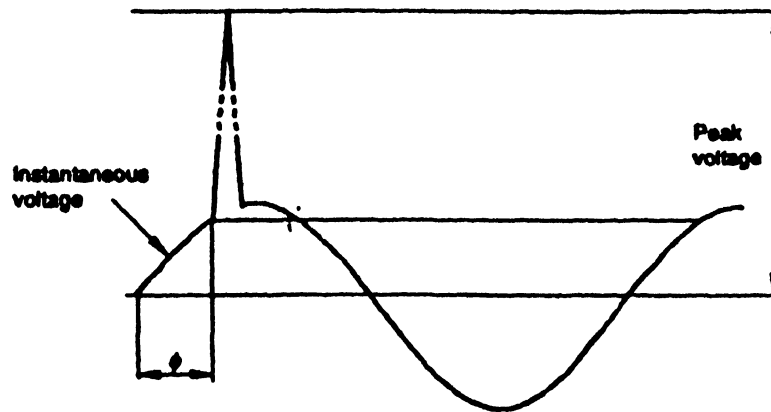


FIG. D-3

D-1.4 The inductance and resistance of the whole circuit, including the items of the various components in D-1.1 and including any fuse and all wiring, shall meet the following requirements:

- a) for lamp voltage ratings between 200 V and 250 V
 - resistance (Ω): 0.4 to 0.45
 - inductance (mH): 0.6 to 0.65
- b) for lamp voltage ratings between 100 V and 150 V
 - resistance (Ω): 0.3 to 0.35
 - inductance (mH): 0.6 to 0.65

D-2 TEST PROCEDURES

D-2.1 The lamp to be tested shall be inserted in the lampholder and the safety cover put in place.

D-2.2 The lamp shall be switched on applying line voltage only. At least 5 s later, a single high-voltage pulse is applied. If the lamp remains lit, the application of the pulse shall be repeated five times.

D-2.3 If the lamp still remains lit, it may be conditioned by being operated at an over-voltage for a period of calculated time equivalent to 60 percent of rated life (see H-2.3). It shall then be re-subjected to the high-voltage pulse set out in D-2.2.

The equivalent life shall be calculated in accordance with the following equation:

$$L_0 = L \left(\frac{U}{U_0} \right)^n$$

where

L_0 = life at rated voltage,

L = life at test voltage,

U_0 = rated voltage,

U = test voltage, and

n = 13 for vacuum lamps and 14 for gas filled lamps.

D-3 CONDITIONING PROCEDURE

D-3.1 Conditioning by a Test House

Test houses are permitted to condition up to 10 percent over voltage. Any burnouts occurring during this conditioning shall be counted in the final assessment, provided the impedance limits are met.

D-3.2 Conditioning by the Manufacturer

Conditioning is permitted up to 30 percent over voltage. If the over voltage is greater than 10 percent or the test racks do not comply with the requirements, then burnouts occurring during the conditioning shall not be counted in the final assessment.

NOTE — The conditioning requirements for a test house are different from those of a manufacturer in order to ensure that a test house does not inadvertently put unrealistic stresses on the lamps during conditioning. On the other hand, they give the manufacturer the possibility of saving testing time and costs by using his detailed knowledge of the stresses his lamps can resist.

D-4 INSPECTION AND ASSESSMENT

After the test, each test lamp is examined. If either,

- a) the bulb is no longer intact, or
- b) the bulb is detached from the cap, or
- c) for bayonet caps only there is a short-circuit between either one of the contacts and the shell,

then the lamp is deemed to have failed the test and is counted as a non-conformity.

If the lamp remains lit after the test procedure specified in D-2.3, it is deemed to have passed.

ANNEX E

(Clause 4.9)

OPERATION-TO-FAILURE TEST

The test shall be carried out under the following conditions.

E-1 The test is continued until end of life. The test is carried out at the rated voltage $^{+10}_0$ percent except on lamps marked with a voltage range where this voltage range exceeds 2.5 percent of the mean voltage when the test is carried out at the upper marked voltage $^{+10}_0$ percent.

E-2 The operating position shall be cap-up unless otherwise specified by the manufacturer. The lampholder's axis on the test racks shall not deviate from the specified operating position by more than 5°.

E-3 The test equipment shall be in accordance with the following requirements:

- lampholders on test racks shall be of sturdy construction and shall be so designed to ensure adequate electrical contact and to prevent overheating;
- the voltage drop between the point of measurement on the supply line and the cap contacts shall not exceed 0.1 percent of the test voltage;
- for bayonet lampholders the cap shall be substantially at the same potential as the contact which is not connected to the fused main supply lead;
- the temperature in operation at the junction between the cap and the bulb shall not exceed the appropriate limit given in Table J-1;
- lamps shall not be operated at excessive temperatures nor shall there be undue heating of a lamp by others;
- lamps shall operate free from noticeable vibration. No vibration or shocks shall be perceptible when touching the lampholders,

either during operation or when switching on or off; and

- lamps shall be switched off twice daily for periods of not less than 15 min.

NOTE — It is recommended that bayonet lampholders of the spring-loaded plunger type are not used for prolonged testing.

E-4 For lamps of 100 V to 250 V rating, the test rack circuit shall have the characteristics specified in Table E-1 when measured by the method given in Annex H.

Table E-1 Test Rack Circuit Characteristics
(Clause E-4)

	100 V to 150 V	200 V to 250 V
— Resistance (Ω)	Note 3	0.5 ± 0.1
— Inductance (mH)	Note 3	0.5 ± 0.1 Note 1
— Individual external lamp fuse, minimum rating (A)	Note 3	10 slow acting
— Surge limits (V)	Note 2	Note 2
NOTES 1 Manufacturers undertaking their own testing may use higher levels of inductance provided the total impedance does not exceed 0.7 Ω. 2 A surge limiting means may be fitted to comply with the performance requirements of IS 418. 3 Under consideration.		

E-5 For 200 V–250 V test racks, the maximum lamp current loading that shall be switched on simultaneously is 16 A.

ANNEX F

(Clause 5.2.7 and Table 6)

ACCEPTANCE NUMBERS FOR VARIOUS SAMPLE SIZES AND AQLs

Table F-1 Acceptance Numbers — Attribute Tests

Number of Lamps Inspected	Acceptance Number (Permitted Number of Non-conformities Shown in Manufacturer's Records) for Various AQLs				
	AQL = 0.25 %	AQL = 0.4 %	AQL = 0.65 %	AQL = 1.5 %	AQL = 2.5 %
32	—	—	—	1	2
50	—	—	—	2	3
80	—	—	1	3	5
125	—	—	2	5	7
200	—	—	3	7	10
315	2	3	5	10	14
500	3	5	7	14	21
800	5	7	10	21	—
1 250	7	10	14	—	—
etc.	—	—	—	—	—

Table F-2 Acceptance Numbers: AQL = 0.25%

Part 1		Part 2	
Number of Lamps in Manufacturer's Records	Acceptance Number	Number of Lamps in Manufacturer's Records	Acceptance Number as Percentage of Lamps in Records
315	2	2 001	0.485
316 to 500	3	2 200	0.48
501 to 635	4	2 600	0.44
636 to 800	5	3 300	0.44
801 to 1 040	6	4 200	0.42
1 041 to 1 250	7	5 400	0.40
1 251 to 1 500	8	7 200	0.38
1 501 to 1 750	9	10 000	0.36
1 751 to 2 000	10		

Table F-3 Acceptance Numbers: AQL = 0.4%

Part 1		Part 2	
Number of Lamps in Manufacturer's Records	Acceptance Number	Number of Lamps in Manufacturer's Records	Acceptance Number as Percentage of Lamps in Records
315	3	2 001	0.73
316 to 400	4	2 150	0.72
401 to 500	5	2 400	0.70
501 to 650	6	2 750	0.68
651 to 800	7	3 250	0.66
801 to 950	8	3 750	0.64
951 to 1 100	9	4 500	0.62
1 101 to 1 250	10	5 400	0.60
1 251 to 1 400	11	6 700	0.58
1 401 to 1 600	12	8 500	0.56
1 601 to 1 800	13	11 000	0.54
1 801 to 2 000	14	15 000	0.52
		22 000	0.50
		33 500	0.48
		60 000	0.46
		130 000	0.44
		540 000	0.42
		1 000 000	0.41

Table F-4 Acceptance Numbers: AQL = 0.65%

Part 1		Part 2	
Number of Lamps in Manufacturer's Records	Acceptance Number	Number of Lamps in Manufacturer's Records	Acceptance Number as Percentage of Lamps in Records
80	1	2 001	1.03
81 to 125	2	2 100	1.02
126 to 200	3	2 400	1.00
201 to 260	4	2 750	0.98
261 to 315	5	3 150	0.96
316 to 400	6	3 550	0.94
401 to 500	7	4 100	0.92
501 to 600	8	4 800	0.90
601 to 700	9	5 700	0.88
701 to 800	10	6 800	0.86
801 to 920	11	8 200	0.84
921 to 1 040	12	10 000	0.82
1 041 to 1 140	13	13 000	0.80
1 141 to 1 250	14	17 500	0.78
1 251 to 1 360	15	24 500	0.76
1 361 to 1 460	16	39 000	0.74
1 461 to 1 570	17	69 000	0.72
1 571 to 1 680	18	145 000	0.70
1 681 to 1 780	19	305 000	0.68
1 781 to 1 890	20	1 000 000	0.67
1 891 to 2 000	21		

Table F-5 Acceptance Numbers: AQL = 1.5%

Part 1		Part 2	
Number of Lamps in Manufacturer's Records	Acceptance Number	Number of Lamps in Manufacturer's Records	Acceptance Number as Percentage of Lamps in Records
32	1	991	2.40
33 to 50	2	1 150	2.35
51 to 80	3	1 300	2.30
81 to 110	4	1 450	2.25
111 to 125	5	1 700	2.20
126 to 165	6	2 000	2.15
166 to 200	7	2 400	2.10
201 to 240	8	2 900	2.05
241 to 285	9	3 500	2.00
286 to 315	10	4 350	1.95
316 to 360	11	5 400	1.90
361 to 410	12	8 000	1.85
411 to 460	13	9 400	1.80
461 to 500	14	13 500	1.75
501 to 545	15	21 000	1.70
546 to 585	16	38 000	1.65
586 to 630	17	86 000	1.60
631 to 670	18	310 000	1.55
671 to 710	19	1 000 000	1.53
711 to 755	20		
756 to 800	21		
801 to 850	22		
851 to 915	23		
916 to 990	24		

Table F-6 Acceptance Numbers: AQL = 2.5%

Part 1		Part 2	
Number of Lamps in Manufacturer's Records	Acceptance Number	Number of Lamps in Manufacturer's Records	Acceptance Number as Percentage of Lamps in Records
32	2	1 001	3.65
33 to 50	3	1 075	3.60
51 to 65	4	1 150	3.55
66 to 80	5	1 250	3.50
81 to 100	6	1 350	3.45
101 to 125	7	1 525	3.40
126 to 145	8	1 700	3.35
146 to 170	9	1 925	3.30
171 to 200	10	2 200	3.25
201 to 225	11	2 525	3.20
226 to 255	12	2 950	3.15
256 to 285	13	3 600	3.10
286 to 315	14	4 250	3.05
316 to 335	15	5 250	3.00
336 to 360	16	6 400	2.95
361 to 390	17	8 200	2.90
391 to 420	18	11 000	2.85
421 to 445	19	15 500	2.80
446 to 475	20	22 000	2.75
476 to 500	21	34 000	2.70
501 to 535	22	60 000	2.65
536 to 560	23	110 000	2.60
561 to 590	24	500 000	2.55
591 to 620	25	1 000 000	2.54
621 to 650	26		
651 to 680	27		
681 to 710	28		
711 to 745	29		
746 to 775	30		
776 to 805	31		
806 to 845	32		
846 to 880	33		
881 to 915	34		
916 to 955	35		
956 to 1 000	36		

For larger samplings of test data than those given in the relevant tables, the acceptance number shall be obtained from the following formula:

$$Q_L = \frac{AN}{100} + 2.33 \sqrt{\frac{AN}{100}}$$

where

N = number of lamps in records;

A = appropriate percentage; and

Q_L = acceptance number.

If a fraction results, it shall be rounded to the nearest whole number.

ANNEX G

(Clause 4.9)

INDUCED-FAILURE TEST — GROUPING, SAMPLING AND COMPLIANCE

G-0 This test is a design test that shall be made in the case of a design change.

G-1 GROUPING

Classes of lamps are generally assessed separately, but:

- a) Classes which differ only in respect to the cap may be grouped as follows:
B15 and B22
E14 and E27
- b) Classes which differ only in having different finishes, for example, white, coloured, mirrored may be grouped provided that the tests are carried out on those classes having an extra coating rather than on clear or frosted lamps. If there are lamps with an inside coating these should be chosen in preference to lamps with an outside coating.

G-2 SAMPLING

G-2.1 If only one class (or classes as grouped in G-1) is to be assessed, then a sample of 125 is taken a second sample of 125 may be necessary depending on the result (*see* G-4.2).

G-2.2 If several classes (or grouped classes) are to be tested, then the number of samples per class may be reduced to not less than 50 providing that the total sample for all classes is at least 1 000, and the initial samples from each class are approximately equal.

G-2.3 In the case where burn-out in the induced-failure test does not always occur, a definitive result may be ascribed providing that in each class tested not less than 25 lamps burn-out. If less than 25 lamps burn-out, one of the two procedures below shall be applied.

G-2.3.1 The number of lamps submitted to the test shall be increased until 25 have burnt-out. If this still fails to achieve the requisite number of burn-outs, a quantity of lamps sufficient to make up the number to 25 shall be subjected to the procedures of D-3 and D-4. A definite result may be ascribed providing, in each class tested, not less than 25 lamps pass the induced-failure test.

G-2.3.2 Alternatively, a sufficient number of lamps to complete the minimum number specified in G-2.3 shall be subjected to the procedures of D-3 and D-4. A definite result may be ascribed providing, in each class tested, not less than 25 lamps pass the induced-failure test.

G-3 ALTERNATIVE TEST DATA

G-3.1 Provided the requirements of G-1, G-2.1 and G-2.2 are met; it shall be permissible to use, for the mandatory design test, the procedure given in Annex E in place of that in Annex D.

G-3.2 Provided that there have been no design changes, operation-to-failure data accumulated over any period under the conditions of Annex E may be used wholly or partly in place of part of the sample requirements of G-2.1 and G-2.2 on a one-for-one basis.

G-4 CONDITIONS OF COMPLIANCE

G-4.1 If one class only is being assessed (*see* G-2.1) the result of the first 125 lamps is considered and action taken as follows:

- zero non-conformity* : pass;
- two (or more) non-conformities: reject;
- one non-conformity: take a second sample of 125; the test is passed only if there are no more non-conformities.

* Non-conformity is defined in D-4.

If a second sample is taken, the requirements of G-2.3 apply separately to the second sample.

G-4.2 If a reduced sample size is used in accordance with G-2.2, assessment is made on the total of all classes taken together but if, in any individual class (or grouped class), there are:

- a) *Two or more non-conformities:*
all classes submitted are deemed to have failed; and
- b) *One non-conformity:*
additional samples of this class are taken and, provided there are no more non-conformities by the time the total sample for the class has reached 250, the class has passed.

When all classes have been assessed individually, the total number of lamps in all classes, taken together, is referred to Table 6. All classes are deemed to have passed if the number of non-conformities does not exceed the corresponding acceptance number or qualifying percentage limit.

When a small number of classes is being assessed, such that the sample size is not reduced, they are treated individually in accordance with G-4.1.

G-5 EXAMPLES TO ILLUSTRATE APPLICATIONS OF THE INDUCED-FAILURE TEST SAMPLING

G-5.1 A manufacturer wishes to assess the following classes:

- 200 V - 250 V 40 W SC frosted;
- 200 V - 250 V 40 W CC inside white;
- 200 V - 250 V 40 W CC red, blue, green and yellow (the colours being external glazes);
- 200 V - 250 V 60 W CC frosted;
- 200 V - 250 V 60 W CC bowl mirror.

Manufacturer takes:

- 125 samples of 40 W SC frosted;
- 125 samples of 40 W CC inside white;
- 125 samples of 60 W CC bowl mirror.

(In each case a further sample of 125 may be necessary if one non-conformity occurs.)

G-5.2 A manufacturer wishes to assess 11 classes. He takes 91 lamps from each class (total sample: 1 001).

G-5.3 A manufacturer wishes to assess 25 classes. Initially he takes 50 lamps per class (total sample: 1 250).

G-5.4 The testing given in example G-5.2 precedes and in one class out of the 91 lamps only 27 burn-out without any bulb failing to comply with D-4. As the number of burn-outs exceeds 25 and there are no non-conformities in the 91 lamps tested, the test on this class is passed.

G-5.5 Again, taking the example G-5.2, in another class only 13 burn-out.

The manufacturer may then take a further sample to try and achieve 25 burn-outs. This could involve possibly another 85 lamps or he could test 12 lamps in accordance with G-2.3.2 and D-4 to obtain a result for this class.

G-5.6 In example G-5.2, 91 lamps were taken and in one class 39 burn-out, but one failed to comply with D-4. A further sample of 159 is taken. This time 70 lamps burn-out but none fails to comply with D-4. 250 lamps of this class have now been tested with 109 burn-outs and one failing to comply with D-4. This meets the individual class requirement, but the results of all 11 classes shall be summarized and applied to Table 6.

G-5.7 In example G-5.1:

The test on 125, 40 W inside white lamps gives 103 burn-outs and one non-conformity. A further 125 lamps are taken with 87 burn-outs and one more non-conformity. The result is assessed on the basis of 250 test results and two non-conformities. Thus, all the manufacturer's 200 V to 250 V, 40 W, CC, inside white and colours are deemed not to be in compliance.

G-5.8 In example G-5.1:

The test on 125, 60 W bowls mirror lamps gives 7 burn-outs with no non-conformities; 18 lamps are put on life test and one fails to comply with D-4. A further sample of 125 is taken. On the induced-failure test, 11 burn-outs occur with no non-conformities. 14 lamps are then tested in accordance with G-2.3.2 and D-4, none of which fail to comply with D-4 at the end of life.

The result is now one non-conformity in 250 lamps tested and is, therefore, a pass.

ANNEX H

(Clause E-4)

METHOD OF MEASURING MAINS IMPEDANCE

The method shown below enables mains impedance to be measured with sufficient accuracy to show that test conditions comply with the requirements of D-2 and E-4.

This method uses currents that occur under the conditions of normal operation whilst maintaining the mains voltage.

On the principle of “ ΔU measurements” a measurable potential difference U is produced by large resistive and inductive loads. Figure H-1 shows the bridge circuit.

Terminals a and b of the bridge are the terminals of the mains where the impedance is to be found.

The e.m.f. of the mains is E_m and its impedance $Z_m = R_m + jx_m$.

When either R_{21} or X_{22} has been switched into circuit, the bridge is balanced if closure of S does not alter voltage U_{ac} , that is, $\Delta U = 0$.

The equilibrium conditions are:

$$R_m = \frac{R_{21}}{R_4} R_3 = R_m \text{ for the resistive bridge;}$$

$$X_m = \frac{X_{22}}{R_4} R_3 = X_m \text{ for the inductive bridge.}$$

R_{21} and X_{22} are loads that produce a current of approximately 10 A,

The fixed resistor R_4 and resistance box R_3 (adjustable in three decades) together constitute the high resistance branch. For switch S , a triac may be used which switches at the current zero point.

The equipment to measure ΔU shall have sensitivity sufficient to identify the null point. In determining R_m and X_m slight errors will occur due to X_m and $(R_m + R_{22})$, respectively. R_{22} is the relatively low but nevertheless unavoidable resistance of load X_{22} . The error present in finding R_m will be negligible.

The error in determining X_m , will usually be a few per cent and therefore negligible. If it exceeds 10 percent a correction should be made in accordance with the normal rules of electrical engineering.

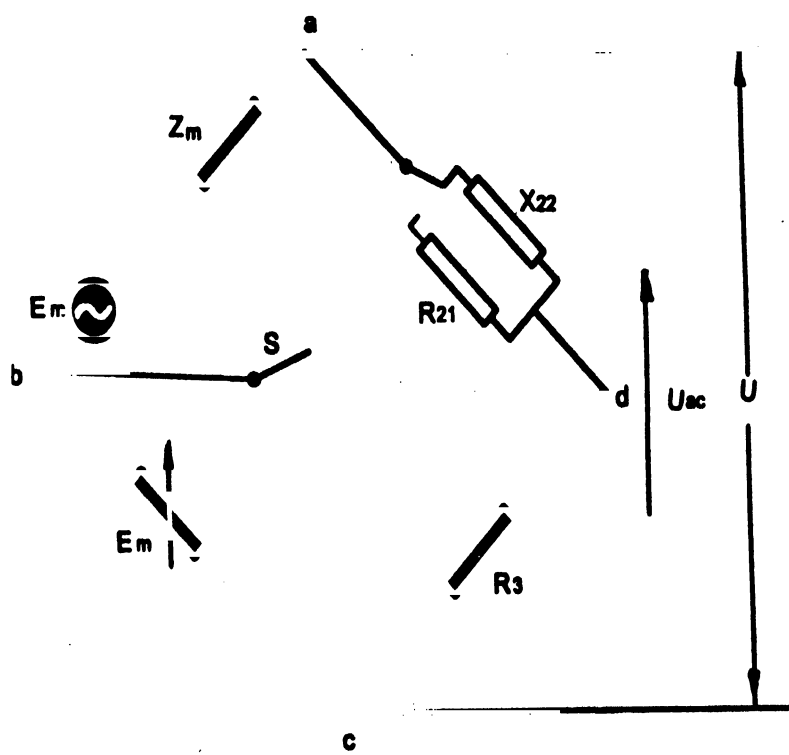


FIG. H-1 BRIDGE CIRCUIT

ANNEX J

(Clause 4.11)

INFORMATION FOR LUMINAIRE DESIGN

J-1 GUIDELINES FOR SAFE LAMP OPERATION

To ensure safe lamp operation, it is essential to observe the following recommendations.

J-2 MAXIMUM CAP TEMPERATURE

Luminaires should be so designed that the lamp cap temperature does not exceed the maximum cap temperature.

Also, it is necessary to give due consideration to the temperature rise of the lamp cap as specified in Table 2.

To ensure that the thermal endurance of lamp materials is not exceeded, lamps should be operated at cap temperatures that do not exceed the appropriate following limits:

- The maximum cap temperature, in relation to cap type as specified in Table J-1; or
- For certain classes of lamps where 210°C is specified in Table J-1, the manufacturer may choose a design which can withstand a maximum cap temperature of 165°C provided that the rated wattage of the lamp is 15 W or lower and that the lamp is not a reflector or bowl mirror lamp.

Table J-1 Maximum Cap Temperatures
(Clause J-2)

Cap Type	Temperature (°C)
B15d	210
B22d	210
E12	165
E14	210
E27	210
E27/51 × 39 PAR	250
E27/51 × 39 PAR, cool beam 300*	—
*Under consideration.	

J-3 METHOD OF MEASUREMENT

The cap temperature shall be measured in accordance with the relevant test specified in relevant part of IS 10322 by means of a suitable thermocouple system

with the lamp installed in its intended lampholder/ luminaires.

There are two methods of measuring cap temperature.

- Method 1* — The hot junction of the thermocouple is located on the cap shell at a distance of not more than 2 mm from the cap to the bulb junction.
- Method 2* — This method is used in case of doubt.

The hot junction of the thermocouple is located in the cement material, after a hole has been drilled in the cap at a distance of 1 mm to 2 mm from the cap to bulb junction. The most onerous location on the circumference of the cap is chosen (generally as close as possible to the centre position of the filament).

NOTE — For lamp types with mechanically locked caps, there is no need to drill a hole to reach the cement. The thermocouple should be affixed to the cap at a distance of 1 mm to 2 mm from the cap to bulb junction (on skirted caps, this refers to the skirt-to-bulb junction) at the most onerous location.

The temperature measured after thermal stabilization should not exceed the value which corresponds to the maximum cap temperature as given in Table J-1.

The temperature measured after thermal stabilization may be 5°C higher than the corresponding maximum cap temperature given in Table J-1, because of the effects of radiation from the lamp on the hot junction of the thermocouple.

CAUTION — Avoid cap shells that are electrically live when making cap temperature measurements.

J-4 SPECIAL LUMINAIRES

Dichroic reflectorized and bowl mirror lamps marked in accordance with 4.2.2 are applied in special luminaires.

Such lamps are unsuitable for use in ordinary luminaires which accept similarly shaped lamps because overheating could occur. Associated luminaire marking requirements appear in IS 10322 (Part 1).

J-5 LAMP OPERATING POSITION

Certain lamps, such as candle and round bulb lamps, are restricted as to operating position and are marked in accordance with 4.2.3. Such lamps should not be applied in luminaires in the cap-up position.

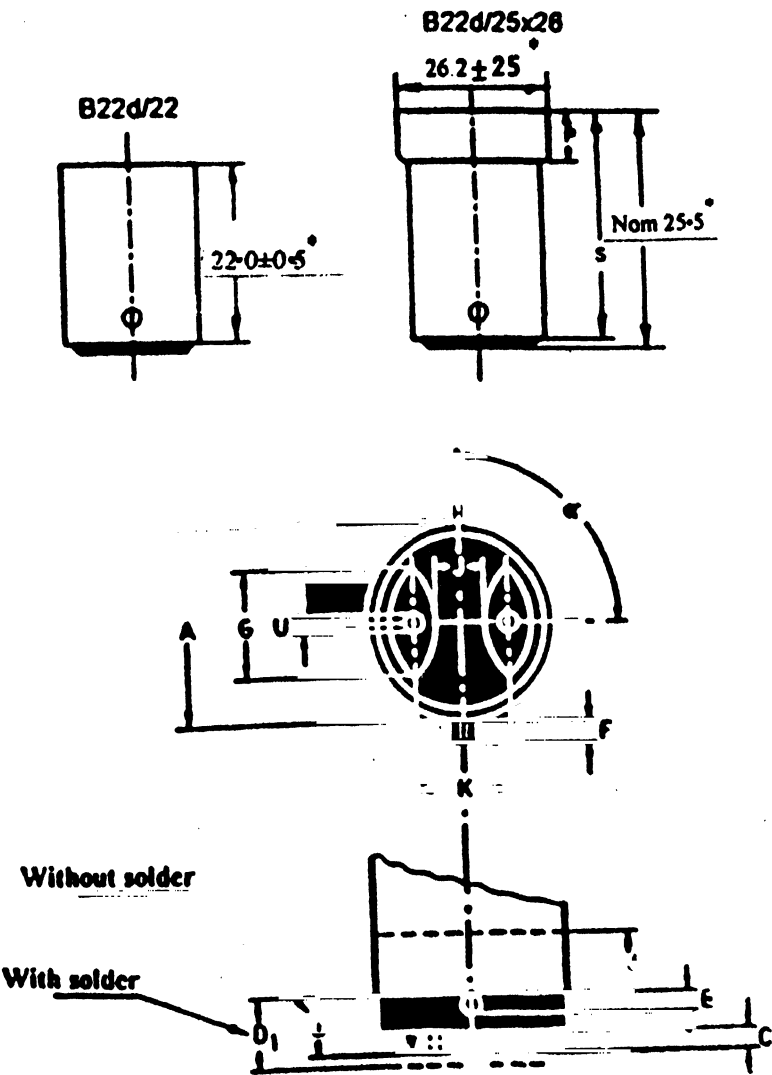
BAYONET CAPS
B22d

Dimensions in millimetres.

The drawings are intended only to indicate dimensions essential for interchangeability.

Caps may be made with a flare* the diameter of which shall be not less than 1 mm greater than the maximum permissible diameter of the corresponding cap without flare.

For finished lamps, the creepage distance over insulation shall be not less than 3 mm between live parts and not less than 2.5 mm between live parts and the metal parts.



Data Sheet No. 7004-10

(Continued)

BAYONET CAPS
B22d

Dimension	Unmounted Caps**		Caps on Finished Lamps		Dimension	Unmounted Caps**		Caps on Finished Lamps	
	Min	Max	Min	Max		Min	Max	Min	Max
A ²⁾	21.75	22.05	21.75	22.15	J	4.0	—	3.0 ¹⁾	—
C	1.9	2.5	—	—	K	10.3 ³⁾	10.5 ³⁾	—	—
D ⁴⁾	6.0	6.8	—	—	N ²⁾	6.7	—	6.7	—
D ¹⁾	—	—	6.0	8.0	P ⁵⁾	7.5	8.5	—	—
E	1.8	2.2	1.8	2.2	S	23.0	23.5	—	—
F	2.3	2.7	2.3	2.7	U	—	1.75 ³⁾	—	—
G	10.0	—	10.0 ¹⁾	—	α	Nom. 90° ³⁾		—	

* These dimensions are solely for cap design and are not to be gauged on the finished lamp.

** The values shown are solely for cap design and are not to be gauged unless otherwise specified.

In those instances where checking of unmounted caps is controlled by neutral authorities, the gauges shown on data sheets 7006-10 and 7006-11 shall be used.

¹⁾ This dimension is checked with a millimetre scale.

²⁾ Dimensions *N* denote the minimum length over which both the minimum and maximum limits of dimension *A* shall be observed. Below dimension *N*, only the limits for dimension *A* maximum apply.

³⁾ These values apply to caps B22d/22 and B22d/25 × 26 which shall be accepted by the gauge shown on data sheet 7006-3.

Dimensions *U* maximum, is to be checked by a suitable plug gauge.

For other caps, dimension *K* may have values of 10.0 mm minimum, 11.3 mm maximum, and angle α limiting value of 82° 30' and 97°30'. The value of dimension *U* is not specified.

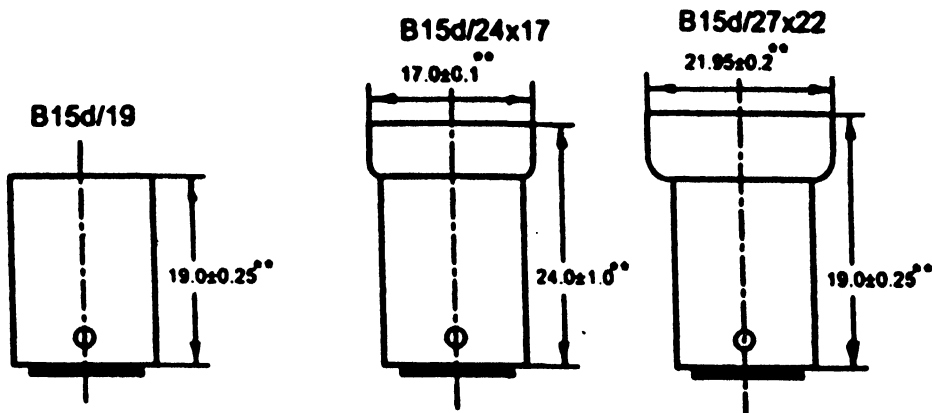
⁴⁾ A displacement in height between the two pins is permitted but this shall not exceed 0.4 mm.

⁵⁾ Dimensions *P* denotes the length over which the skirt shall be cylindrical.

Data Sheet No. 7004-10

BAYONET CAPS
B15

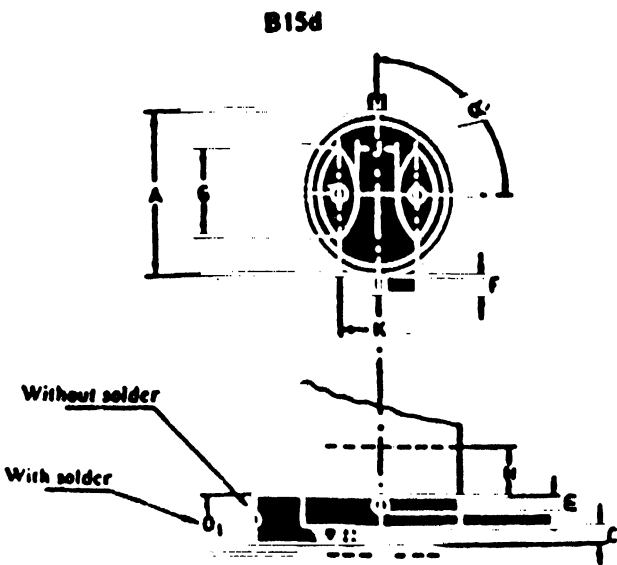
Dimensions in millimetres.



The drawings are intended only to indicate the dimensions essential for interchangeability.

Caps may be made with a flare ** the diameter of which shall be not more than 1 mm greater than the maximum permissible diameter of the corresponding cap without a flare.

For finished lamps the creepage distance over insulation shall be not less than 3 mm between live parts and not less than 2 mm between live parts and the metal shell.



Data Sheet No. 7004-11

(Continued)

BAYONET CAPS
B15

Dimension	Min	Max	Dimension	Min	Max	Dimension	Min	Max
<i>A</i>	15.00	15.25	<i>E</i>	1.80	2.20	<i>J</i> ¹⁾	3.0	—
<i>C</i> ^{**}	1.5	—	<i>F</i>	0.90	1.10	<i>K</i> ^{**}	7.0	8.0
<i>D</i>	6.0	6.6 ^{**}	<i>G</i> ¹⁾	Approx 9		<i>N</i> ²⁾	7.0	—
<i>D</i> ₁	—	7.5	<i>H</i> ¹⁾	Approx 5		α	82° 30'	97° 30'

****** These dimensions are solely for cap design and are not to be gauged on the finished lamp.

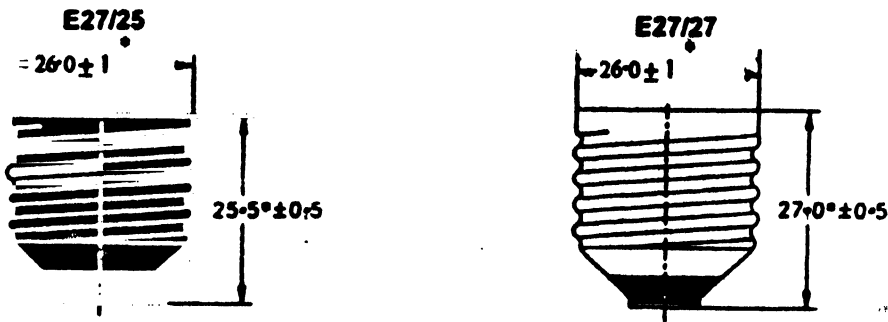
¹⁾ This dimension is checked with a millimetre scale.

²⁾ “*N*” denotes the minimum length to which dimension “*A*” must conform.

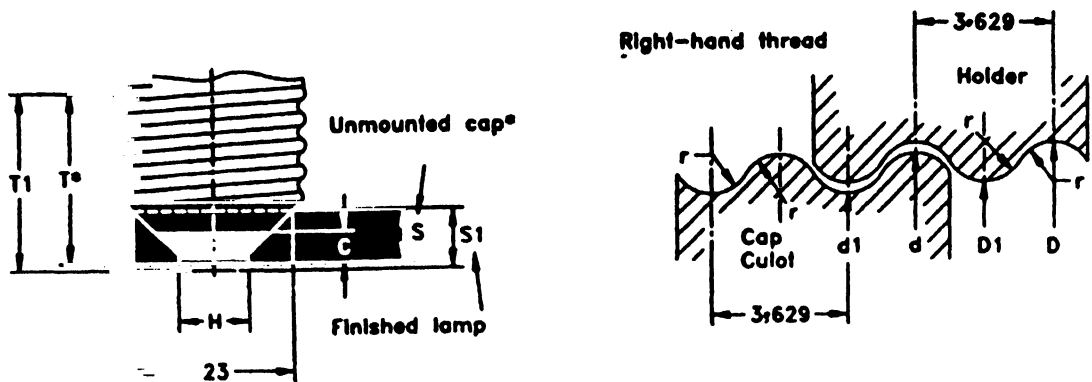
Data Sheet No. 7004-11

SCREW CAPS
E27

The drawing is intended only to illustrate the dimensions essential for interchangeability.



Dimensions in millimetres.



Dimensions in millimetres.

Caps may be made with a flare, the diameter of which shall be not more than 1 mm greater than the maximum permissible diameter of the corresponding cap without a flare.

* These dimensions are solely for cap design and are not to be gauged.

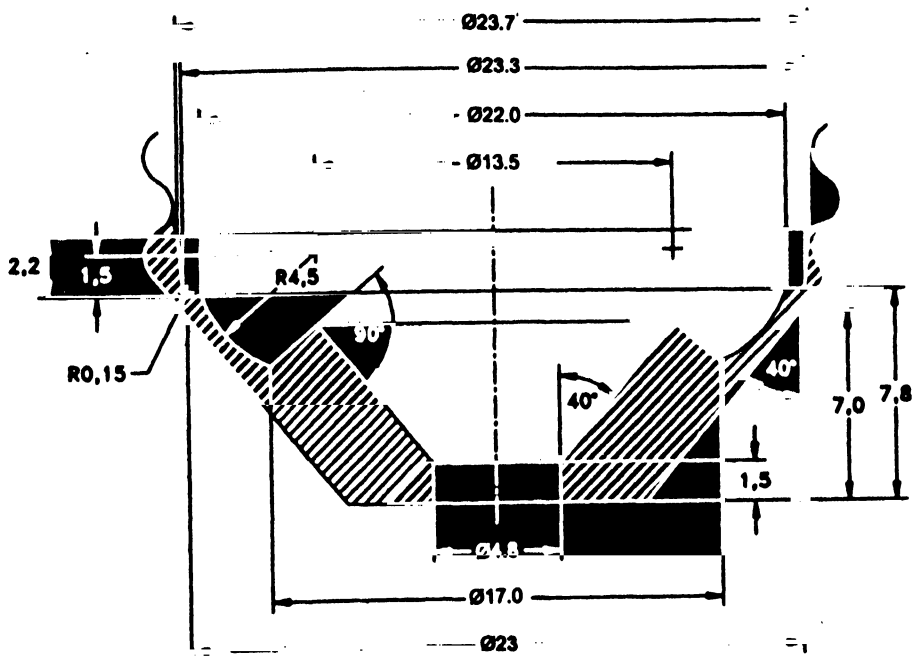
Dimension	Unmounted Caps*		Caps on Finished Lamps	
	Min	Max	Min	Max
C	5)	—	5)	—
H ¹⁾	4.8 ⁶⁾	11.5	4.8 ⁶⁾	11.5
S	7.0	7.8	—	—
S ₁	—	—	7.0	8.5
T ^{*2)}	22.0	—	—	—
T ₁ ³⁾	—	—	22.0	—
d	26.05	26.38	26.05	26.45
d ₁	—	24.19	—	24.26
r ⁴⁾	1.025			

SCREW CAPS
E27

HOLDER DIMENSIONS

Dimensions	Mln	Max
D	26.55	—
D_1	24.36	24.66
$r^{4)}$	1.025	

- ¹⁾ This dimension is checked with a millimetre scale.
²⁾ “ T ” is the distance from the contact plate to the completion of the effective thread on unmounted caps.
³⁾ “ T_1 ” is the distance from the contact plate to the completion of the effective thread on finished lamps.
⁴⁾ This dimension, which is derived from the theoretical thread profile, is for gauge design and is not to be checked on the cap.
⁵⁾ A finishing process with high heat load (for example, welding), might require a minimum H value of 9.5 mm.



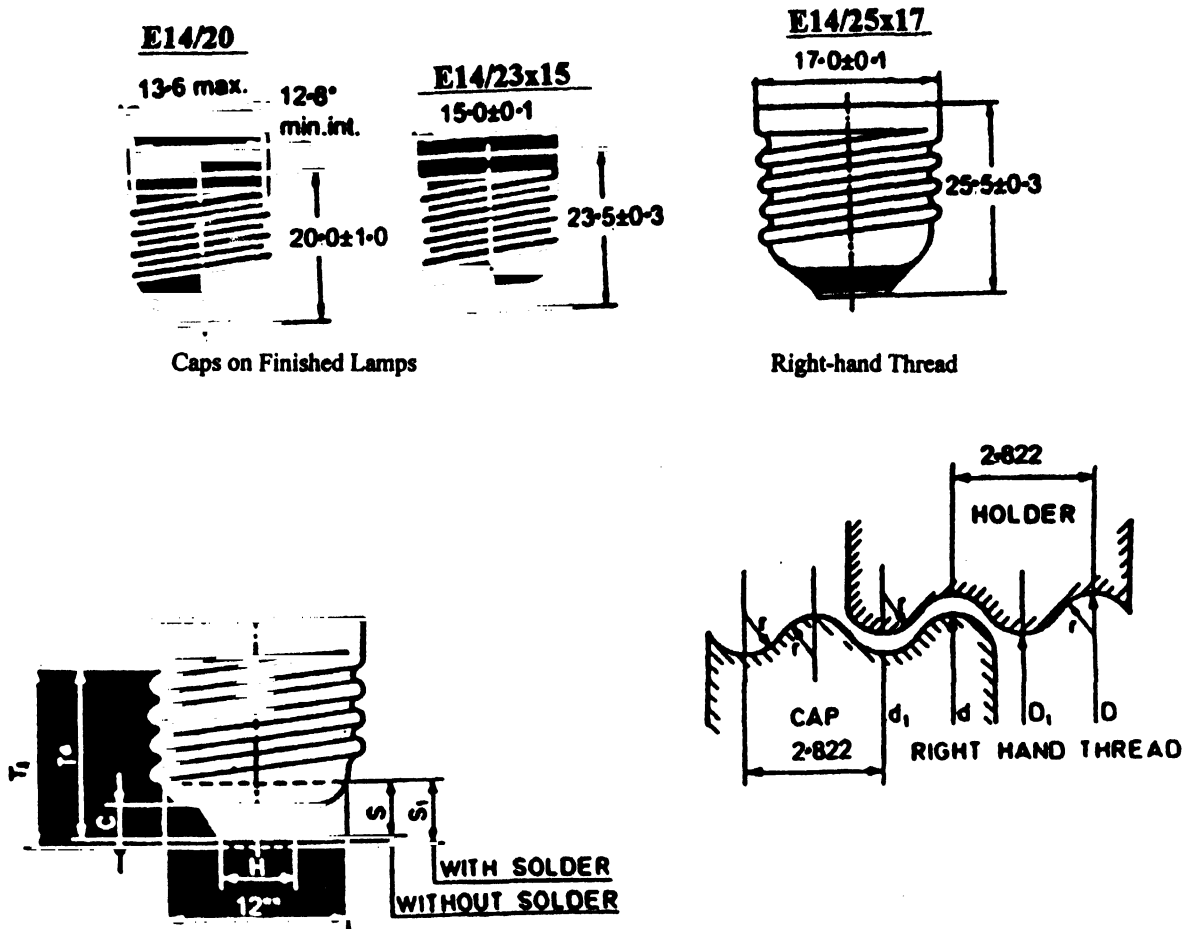
Dimensions in millimetres.

- *These dimensions are solely for cap design and not to be gauged.
Nominal cap design dimensions ** shall be within the hachured area.
Because of manufacturing tolerances it not required that every specimen will lie within contours shown.
** These dimensions are for cap design only and the contours shall not be used for cap gauging purposes.

SCREW CAPS

E14

The drawings are intended only to indicate the dimensions essential for interchangeability.



Dimensions in millimetres.

* Unmounted caps

Caps may be made with a flare the diameter of which shall be not more than 1 mm greater than the maximum permissible diameter of the corresponding cap without a flare.

For finished lamps the creepage distance over insulation shall be not less than 3 mm.

NOTE — The shape of the caps shown in the drawings has been chosen only for the purposes of illustration and does not constitute a requirement.

** This value denotes the diameter of the reference circle to which dimensions S and S_1 are referred.

SCREW CAPS
E14

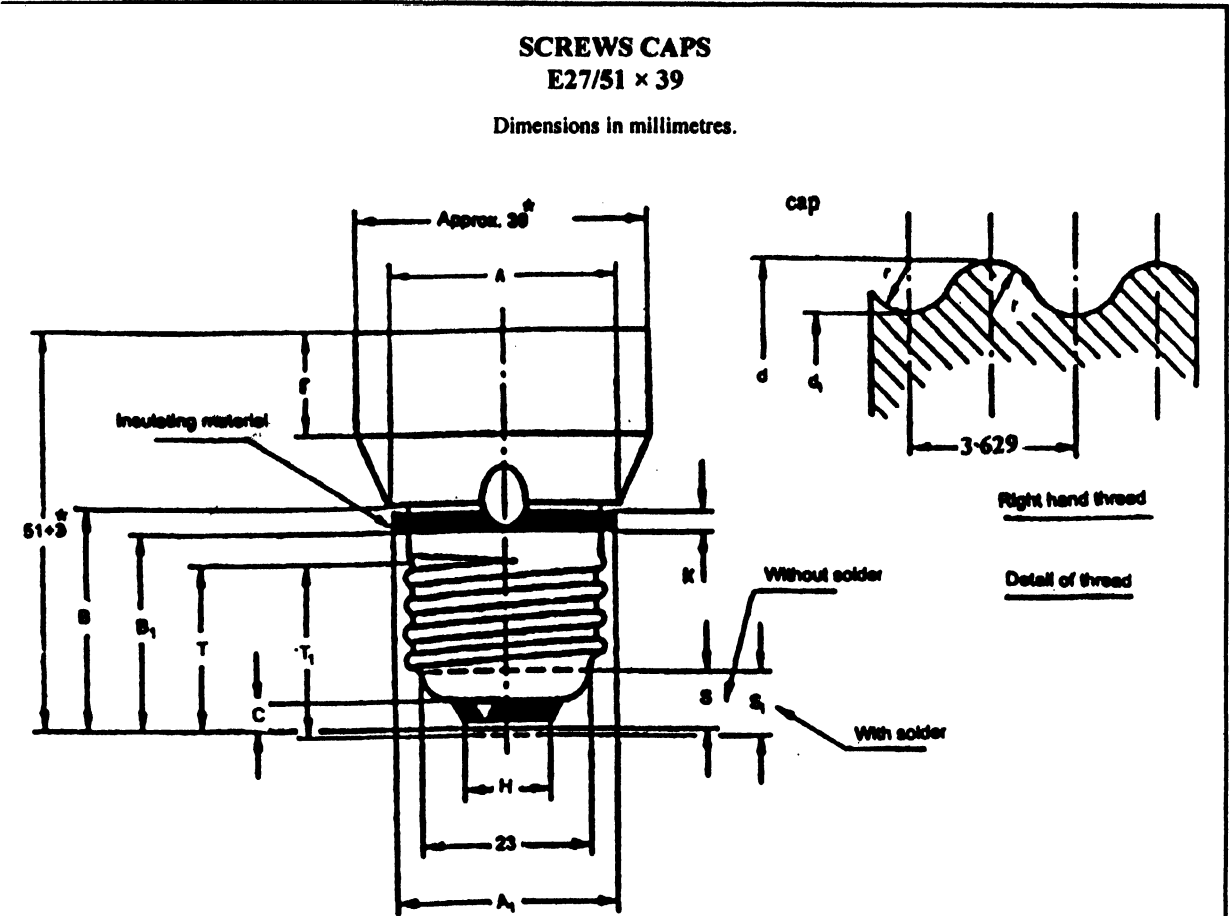
Dimensions in millimetres.

Dimension of Cap	Unmounted Caps*		Caps on Finished Lamps	
	Min	Max	Min	Max
<i>C</i>	3.0	—	3.0	—
<i>H</i>	4.8	6.2	4.8 ¹⁾	6.2 ¹⁾
<i>S</i>	3.2	3.7	—	—
<i>S</i> ₁	—	—	3.5	4.5
<i>T</i> ²⁾	16.0	—	—	—
<i>T</i> ₁ ³⁾	—	—	16.0	—
<i>D</i>	13.6	13.84	13.6	13.89
<i>d</i> ₁	—	12.24	—	12.29
<i>r</i> ⁴⁾	0.822		0.822	

Dimension of Holder	Min	Max
<i>D</i>	13.97	—
<i>D</i> ₁	12.37	12.56
<i>r</i> ⁴⁾	0.822	

* These dimensions are solely for cap design and are not to be gauged on the finished lamp.

- ¹⁾ This dimension is checked with a millimetre scale.
- ²⁾ Dimension “*T*” is the distance from the contact plate to the completion of the effective thread.
- ³⁾ Dimension “*T*₁” is the distance from the soldered contact plate to the completion of the effective thread.
- ⁴⁾ This dimension, which is derived from the theoretical thread profile, is for gauge design and is not to be checked on the cap or the holder.



The drawings are intended only to indicate the dimensions essential for interchangeability.

For details lampholder E27, see Data Sheet 7004-21.

Caps may be made with flare the diameter of which shall be not more than 1 mm greater than the diameter of the corresponding cap without a flare.

For finished lamps the creepage distance over insulation between live part and between the insulated skirt and live parts shall be not less than 3 mm.

Except where specified otherwise, the dimensions in the part of the table referring to the cap are applicable to unmounted caps as well as to caps on finished lamps.

Data Sheet No. 7004-27

(Continued)

SCREW CAPS
E27/51 × 39

Dimensions in millimetres.

Dimension	Min	Max
<i>A</i> *	—	31.0
<i>A</i> ₁	—	30.0
<i>B</i>	28.5	—
<i>B</i> ₁	25.0	—
<i>C</i>	3.5	—
<i>E</i>	3.0	—
<i>F</i> *	13.0	14.0
<i>H</i> ⁷⁾	9.5	11.5
<i>S</i> *	7.0	7.8
<i>S</i> ₁ ** ⁵⁾	7.0	8.5
<i>T</i> * ¹⁾	22.0	—
<i>T</i> ₁ ** ²⁾	22.0	—
<i>d</i>	26.05 ⁶⁾	26.45 ⁴⁾
<i>d</i> ₁	—	24.26 ⁴⁾
<i>r</i> ³⁾	1.025	

* This dimension is for cap design only and no provision is made for gauging.

** This dimension applies only to finished lamps.

¹⁾ "T" is the distance from the contact plate to the completion of the effective thread.

²⁾ "T₁" is the distance from the soldered contact plate to the completion of the effective thread, the minimum value being checked by means of the gauge shown on sheet 7006-27B.

³⁾ This dimension, which is derived from the theoretical thread profile is for gauge design and is not to be checked on the cap.

⁴⁾ To be checked by means of the gauge shown on sheet 7006-27B.

⁵⁾ To be checked by means of the gauge shown on sheet 7006-27C.

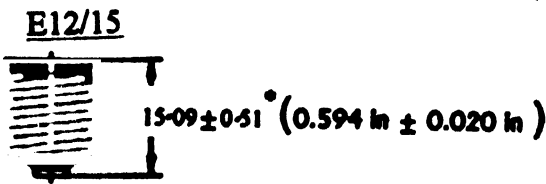
⁶⁾ To be checked by means of the gauge shown on sheet 7006-28A.

⁷⁾ This dimension is checked with a millimetre scale.

Data Sheet No. 7004-27

SCREW CAPS
E12

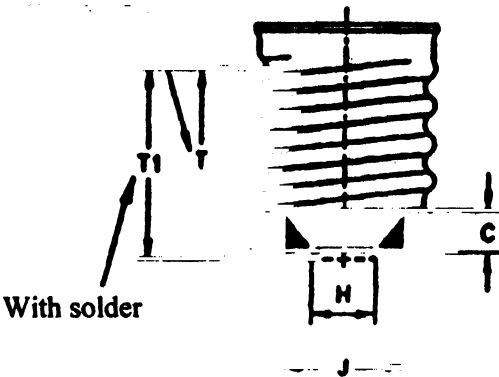
Dimensions in millimetres.



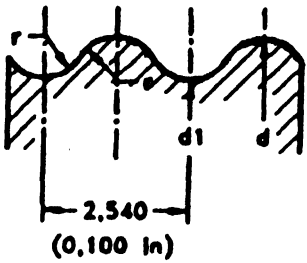
The drawing is intended only to illustrate the dimensions essential for interchangeability.

* These dimensions are solely for cap design and are not to be gauged.

Without solder



Right-hand thread



Caps may be made with a flare, the diameter of which shall not exceed 12.32 mm.

Data Sheet No. 7004-28

(Continued)

**SCREW CAPS
E12**

Dimensions in millimetres.

Standard Dimensions

Dimensions	Unmounted Caps*		Caps on Finished Lamps	
	<i>Min</i>	<i>Max</i>	<i>Min</i>	<i>Max</i>
<i>C</i>	1.60	—	1.60	—
<i>H</i> ¹⁾	3.58	4.37	3.58	4.37
<i>J</i>	—	7.37	—	7.37
<i>T</i> ²⁾	10.66	—	—	—
<i>T</i> ₁ ³⁾	—	—	11.17	—
<i>d</i>	11.56	11.81	11.56	11.887
<i>d</i> ₁	—	10.54	—	10.617
<i>r</i> ⁴⁾	0.792		0.792	

¹⁾ This dimension is checked with a millimetre scale.

²⁾ "*T*" is the distance from the contact plate to the completion of the effective thread.

³⁾ "*T*₁" is the distance from the soldered contact plate to the completion of the effective thread.

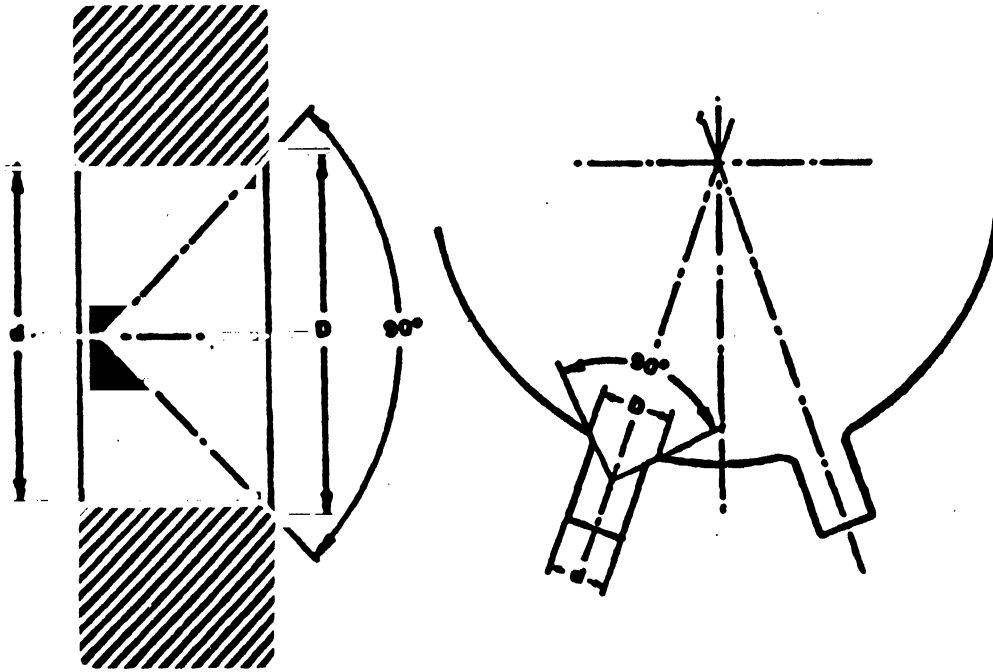
⁴⁾ This dimension, which is derived from the theoretical thread profile, is for gauge design and is not to be checked on the cap.

GAUGING: Caps E12 on finished lamps shall fulfil the tests of the gauges shown on 7006-32, 7006-27H, 7006-27J and 7006-28C.

Data Sheet No. 7004-28

FACETS ON GAUGE EDGES

Wherever a simple rounding off of an edge is to be specified, this shall be done in accordance with the principle shown below. On the specific drawings such edges shall be marked simply as "Edges slightly chamfered (*see* data sheet 7006-1)".



The value of dimension "*D*" is determined by applying the following rules:

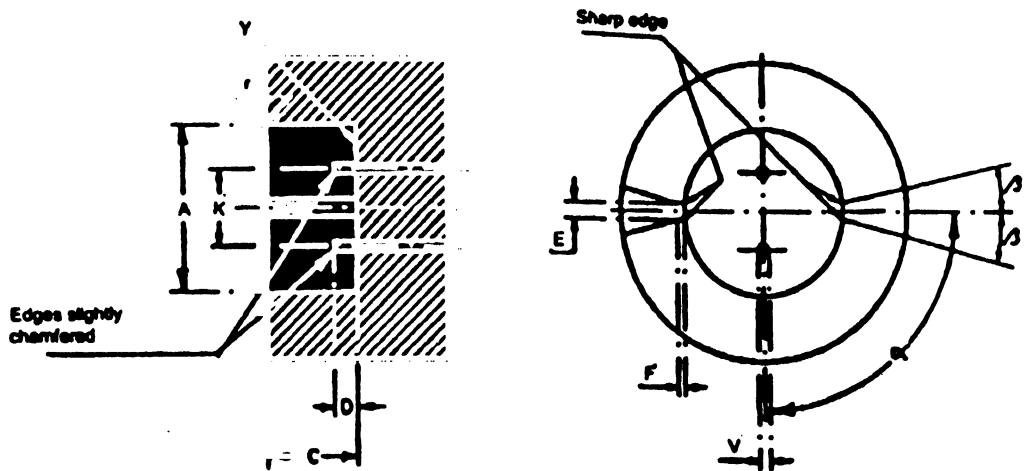
- | | |
|-----------------|---|
| "NOT GO" gauges | " <i>D</i> " = approx. 1.1 <i>d</i> (rounded out to full millimetres) |
| "GO" | When " <i>D</i> " has an influence on the result, its value is fixed accordingly. |
| | When " <i>D</i> " has no influence on the result, " <i>D</i> " = approx. 1.1 <i>d</i> |

Data Sheet No. 7006-1

ACCEPTANCE GAUGE FOR B22d CAPS INTENDED FOR
AUTOMATIC WIRE THREADING

Dimensions in millimetres.

The drawing is intended only to illustrate the essential dimensions of the gauge.



PURPOSE: To check the suitability for automatic wire threading of B22d caps as shown on data sheet 7004-10.

TESTING: The cap shall be assumed to be correct if it can be inserted smoothly into the gauge until the contact plates of the cap touch surface *Y* of the gauge.

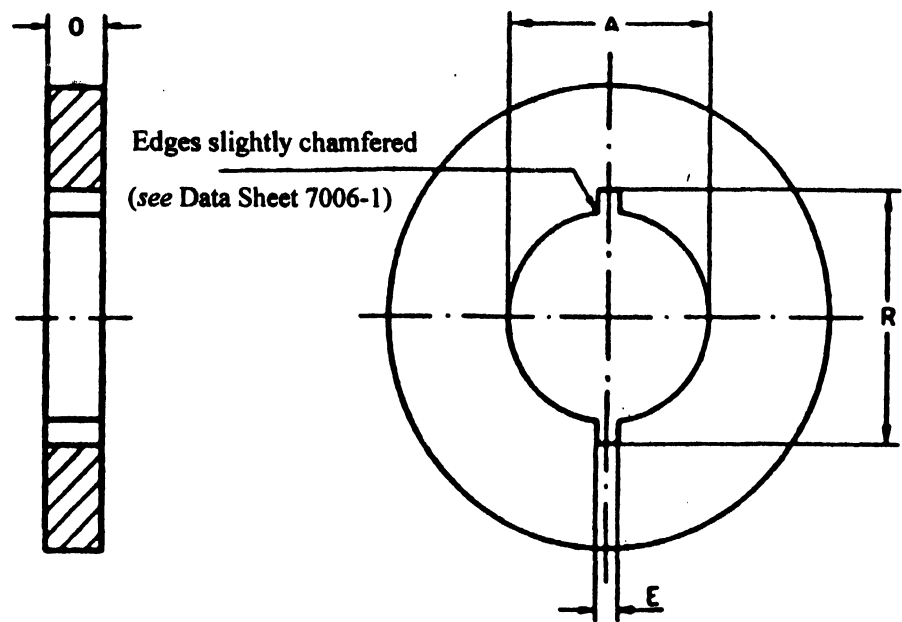
Reference	Dimension	Tolerance
<i>A</i>	22.2	+0.01 −0.01
<i>C</i>	12.7	+0.1 −0.1
<i>D</i>	3.1	+0.1 −0.1
<i>E</i>	2.4	+0.01 −0.01
<i>F</i>	1	+0.1 −0.1
<i>K</i>	10.4	+0.01 −0.01
<i>U</i>	1.3	+0.0 −0.01
<i>r</i>	1.6	+0.2 −0.2
<i>α</i>	90°	+2′ −2′
<i>β</i>	Approx 15°	

GAUGES FOR TESTING THE INSERTION OF
CAPS IN LAMPHOLDERS
B15d and B22d

Dimensions in millimetres.

The drawing is intended only to illustrate the essential dimensions of the gauges.

For details of caps B15d and B22d, see sheets 7004-11 and 7004-10 respectively.



PURPOSE: To check B15d and B22d cap dimensions for insertion of the cap on the finished lamp in the lampholder.

TESTING: Without using undue force it shall be possible to insert the cap into the gauge until the pins have passed completely through the slots.

Reference	Dimension		Tolerance
	B15d	B22d	
A	15.25	22.15	+0.01 -0.0
B	17.45	27.55	+0.01 -0.0
E	2.5		+0.0 -0.04
O	6.5		+0.1 -0.1

Data Sheet No. 7006-4A

**GAUGES FOR TESTING THE RETENTION OF
B15d AND B22d CAPS IN THE HOLDER**

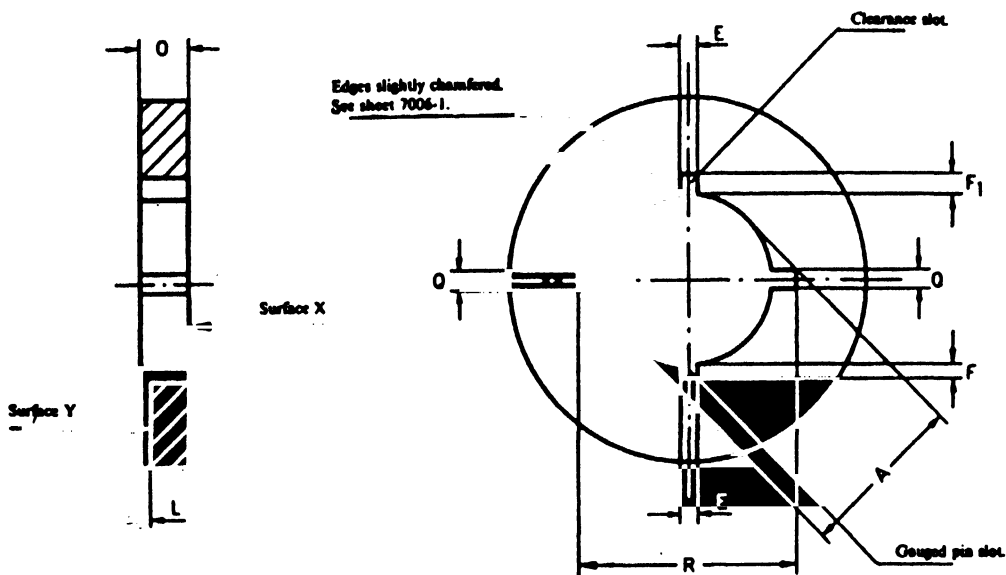
Dimensions in millimetres.

The drawing is intended only to illustrate the essential dimensions of the gauges.

For details of caps B15d and B22d, see data sheets 7004-11 and 7004-10 respectively.

These gauges may be combined with the gauges for checking insertion of caps in the holder as shown on data sheet 7006-4A.

In these combinations, the slots Q and dimensions R are replaced by the equivalent dimensions shown for the gauges for checking insertion of caps in the holder.



PURPOSE: To check cap dimensions for retention of the cap on the finished lamp in the lampholder.

TESTING: The cap of the lamp shall enter the gauge from surface X , until the pins have passed through slots Q . The cap is then turned through 90° for one pin to enter the gauged pin slot. With a slight pull the pin shall not pass surface Y . The test is made twice, the lamp being rotated through 180° , so that each pin in turn is gauged.

Data Sheet No. 7006-4B

(Continued)

GAUGES FOR TESTING THE RETENTION OF
B15d AND B22d CAPS IN THE HOLDER

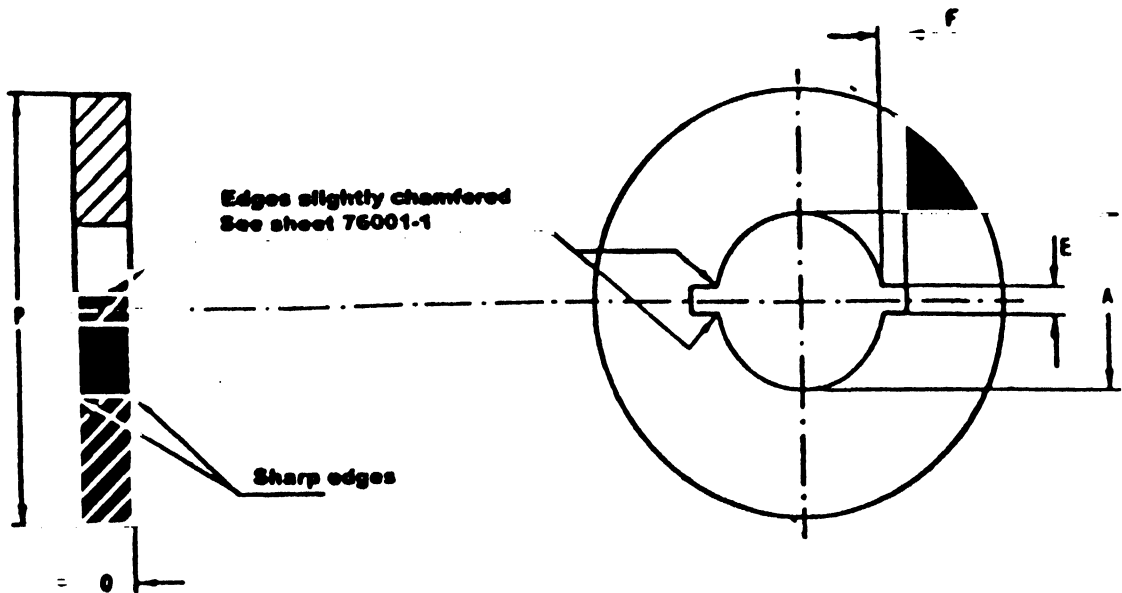
Reference	Dimension		Tolerance
	B15d	B22d	
<i>A</i>	15.25	22.15	+0.01 -0.0
<i>E</i>	2.5	2.5	+0.1 -0.0
<i>F</i> ¹⁾	0.64	1.89	+0.0 -0.01
<i>F</i> ₁ ¹⁾	2	3	+0.1 -0.0
<i>L</i>	1.5	1.5	+0.1 -0.1
<i>O</i>	6.5	6.5	+0.1 -0.1
<i>Q</i>	2.5	2.5	+0.1 -0.0
<i>R</i>	20.5	29.5	+0.0 -1.0

¹⁾ Dimensions *F* and *F*₁ apply along the centre line through the slots of width *E*, where this intersects with the circumference of the circle defined by dimension *A*.

**“NOT GO” GAUGE FOR CAPS ON FINISHED LAMPS
B15 and B22**

Dimensions in millimetres.

The drawing is intended only to illustrate the essential dimensions of the gauges.
For details of caps B15 and B22, see data sheets 7004-11 and 7004-10 respectively.



PURPOSE: To check dimension *A* minimum of caps B15 and B22 on finished lamps respectively.

TESTING: Caps on finished lamps shall be assumed to be correct if the gauge does not pass over the cap by its own weight.

The gauge for B15 may also be used for checking unmouted caps.

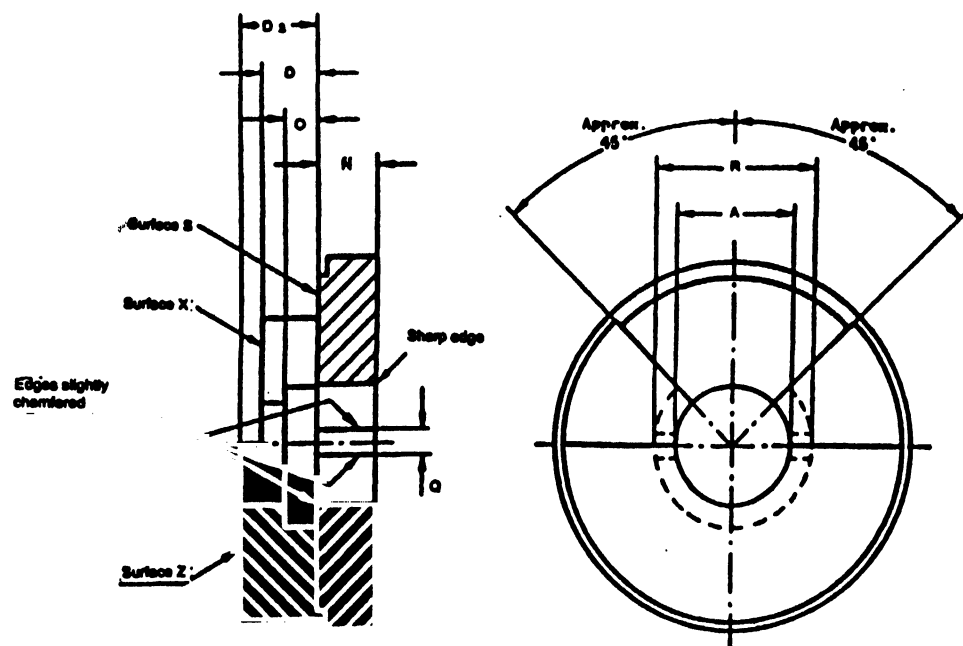
Reference	Dimension		Tolerance
	B15	B22	
<i>A</i>	15.0	21.75	+0.0 -0.01
<i>B</i>	3.5	3.5	+0.5 -0.5
<i>F</i>	3.5	3.5	+0.5 -0.5
<i>O</i>	7	7	+0.1 -0.1
Mass, kg	0.050	0.100	+10% -10%

Data Sheet No. 7006-10

**“GO” GAUGES FOR CAPS ON FINISHED LAMPS
B15 and B22**

Dimensions in millimetres.

The drawing is intended only to illustrate the essential dimension of the gauges.
For details of caps B15 and B22, see data sheets 7004-11 and 7004-10 respectively.



Dimensions *N* of the gauge checks the diameter of the cap for a sufficient length to ensure interchangeability of the cap in the holders.

Reference	Dimension		Tolerance
	B15	B22	
<i>A</i>	15.25	22.15	+0.01 -0.0
<i>D</i>	6.0	6.0	+0.0 -0.01
<i>D₁</i>	7.5	8.0	+0.02 -0.0
<i>N¹⁾</i>	7.0	6.7	+0.0 -0.01
<i>O</i>	3.05	3.05	+0.0 -0.05
<i>Q</i>	2.5	2.5	+0.0 -0.04
<i>R</i>	20.5	29.5	+0.0 -1.0

Data Sheet No. 7006-11

PURPOSE: To check dimensions *A Max*, *N Min*, *D₁ Min*, *D₁ Max* and the dimetrical position of the pins of caps BA9, B15, BA15 and B22 on finished lamps.

TESTING: The cap shall enter the gauge until the pins have passed through the slots *Q*. The cap is then turned through a small angle and is pressed so that the pins are in close contact with surface *S*.

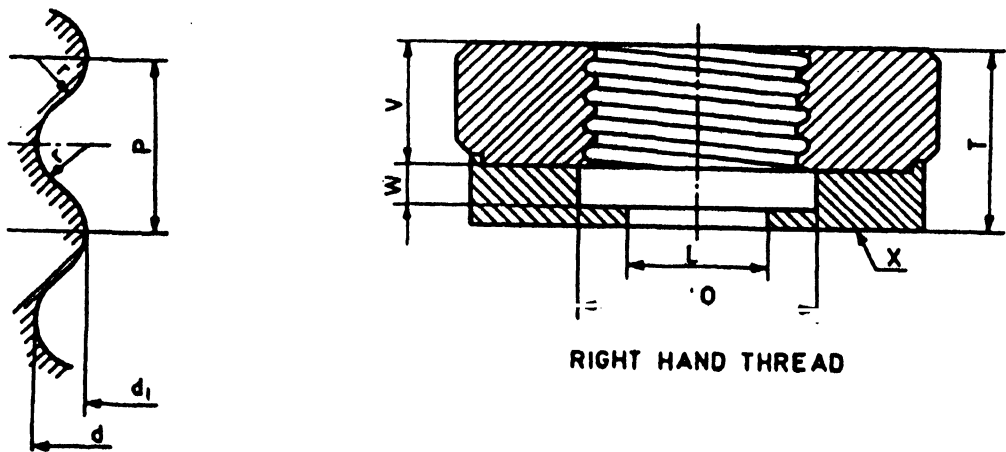
In this position, the contact-making surface shall not be below surface *X* nor shall it project beyond surface *Z*.

NOTE — A similar gauge may be used for checking unmounted caps B15 provided that provision is made for checking dimension *D Max*, as shown on sheet 7004-11.

“GO” GAUGE FOR E27 CAPS ON FINISHED LAMPS

Dimensions in millimetres.

The drawing is intended only to illustrate the essential dimensions of the gauge.



DETAIL OF THREAD

The sharp part of the edge of the thread shall be broken with a radius of 0.2 mm to 0.3 mm.

PURPOSE: To check the maximum dimensions of the screw thread and dimension T_1 minimum of caps on finished lamps shown on data sheet 7004-21.

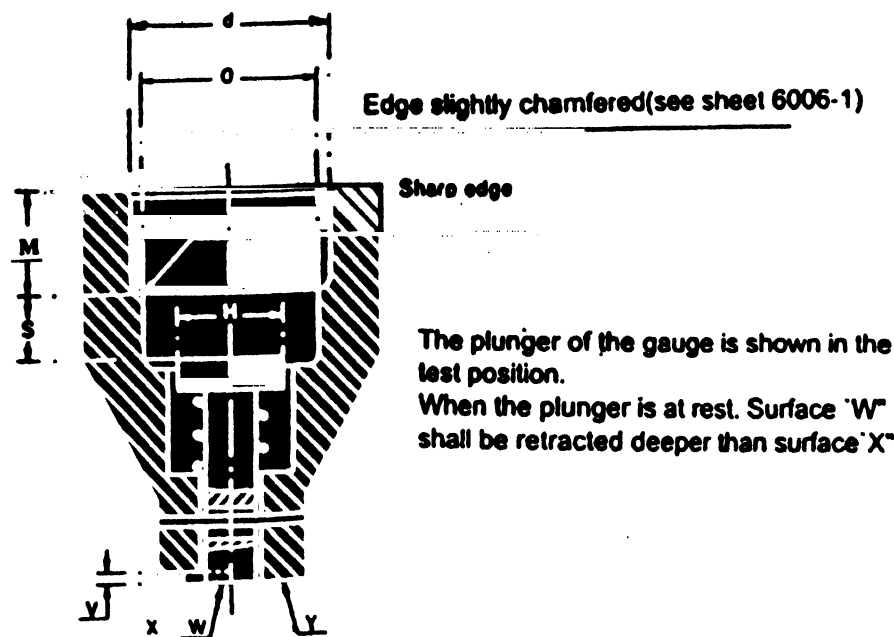
TESTING: When the cap on a finished lamp has been screwed into the gauge as far as it will go, centre contact shall be co-planar with or project beyond, surface X.

Reference	Dimension	Tolerance	Limit After Wear
d	26.45	+0.03 -0.0	26.50
d_1	24.26	+0.03 -0.0	24.31
L	16.5	+0.1 -0.1	—
O	28	+0.2 -0.2	—
P	3.629	—	—
r	1.025	—	—
T	22.0	+0.0 -0.03	—
V	15	+0.1 -0.1	—
W	5	+0.1 -0.1	—

**“GO” GAUGE FOR DIMENSIONS “S₁” OF E27 CAPS
ON FINISHED LAMPS**

Dimensions in millimetres.

The drawing is intended only to illustrate the essential dimensions of the gauge.



The plunger of the gauge is shown in the test position.

When the plunger is at rest, surface “W” shall be retracted deeper than surface “X”.

PURPOSE: To check the dimensions S₁ minimum and S₁ maximum of E27 caps on finished lamps shown on sheet 7004-21.

TESTING: When the cap on a finished lamp has been pushed into the gauge as far as it will go, the plunger surface “W” shall be co-planar with or project beyond surface “X” but it shall not project beyond surface “Y”.

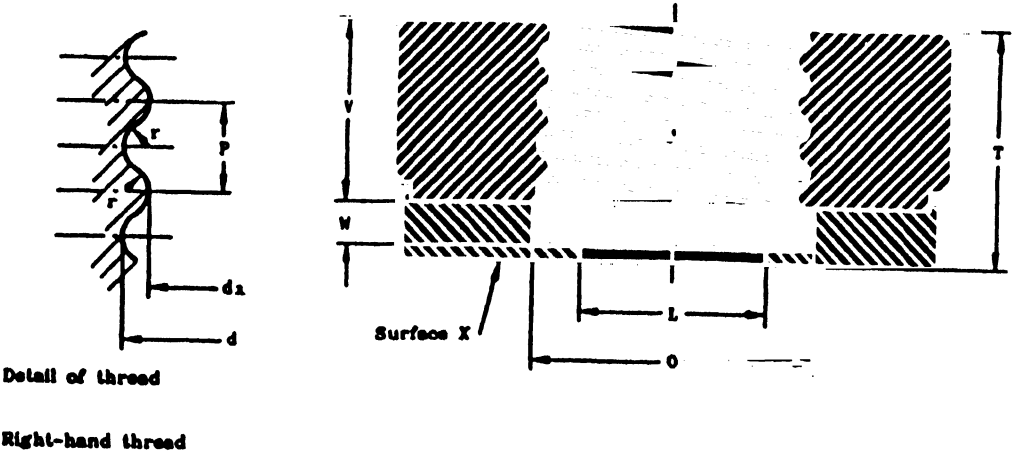
Reference	Dimension	Tolerance
<i>d</i>	26.45	+0.03 -0.0
<i>H</i>	14	+0.1 -0.1
<i>M</i>	13	+0.1 -0.1
<i>O</i>	23.0	+0.03 -0.03
<i>S</i>	8.5	+0.01 -0.0
<i>V</i>	1.5	+0.02 -0.0

Data Sheet No. 7006-27C

“GO” GAUGE FOR E14 CAPS ON FINISHED LAMPS

Dimensions in millimetres.

The drawing is intended only to illustrate the essential dimensions of the gauge.
For details of cap E14, see data sheet 7004-23.



The sharp part of the edge of the thread shall be broken with a radius of 0.2 mm to 0.3 mm.

PURPOSE: To check the maximum dimensions of the screw thread and dimension T_1 minimum of E14 caps on finished lamps.

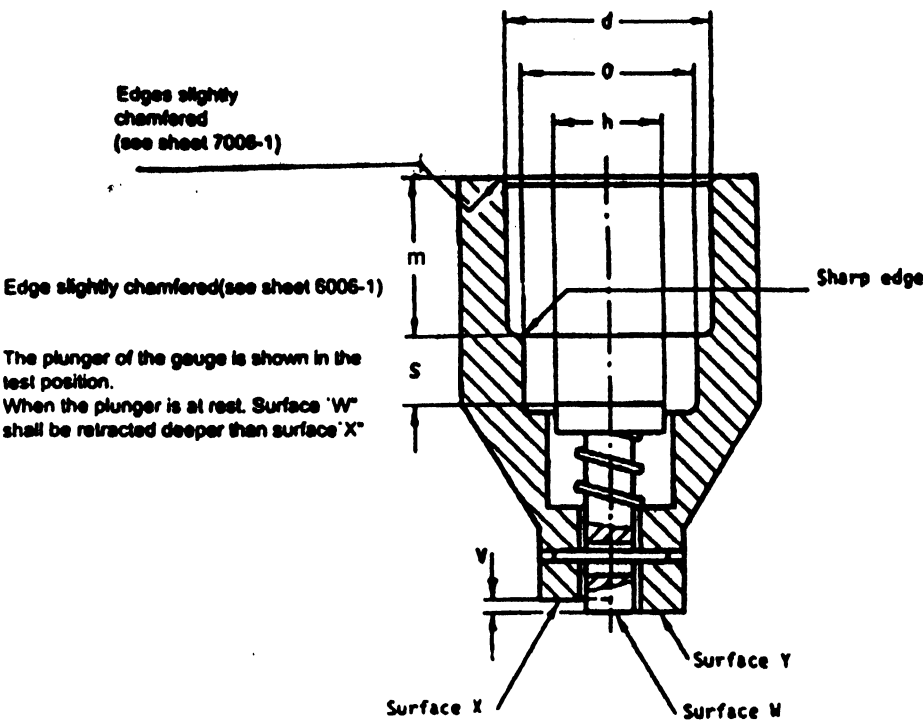
TESTING: When the cap on a finished lamp has been screwed into the gauge as far as it will go, the centre contact shall be co-planar with, or project beyond surface X.

Reference	Dimensions	Tolerance	Limit After Wear
P	2.822	—	—
T	16.0	+0.0 -0.03	—
d	13.89	+0.03 -0.0	13.93
d_1	12.29	+0.03 -0.0	12.33
L	9.5	+0.1 -0.1	—
O	15	+0.2 -0.2	—
r	0.822	—	—
V	12.5	+0.1 -0.1	—
W	2	+0.1 -0.1	1

**“GO” GAUGE FOR DIMENSION “ S_1 ” of E14 CAPS
ON FINISHED LAMPS**

Dimensions in millimetres.

The drawing is intended only to illustrate the essential dimensions of the gauge.
For details of cap E14, see data sheet 7004-23.



The plunger of the gauge is shown in the test position.
When the plunger is at rest, surface *W* shall be retracted deeper than surface *X*.
PURPOSE: To check the dimensions S_1 minimum and S_1 maximum of E14 caps on finished lamps.
TESTING: When the cap on a finished lamp has been pushed into the gauge as far as it will go, the plunger surface *W* shall be co-planar with, or project beyond surface *X* but it shall not project beyond surface *Y*.

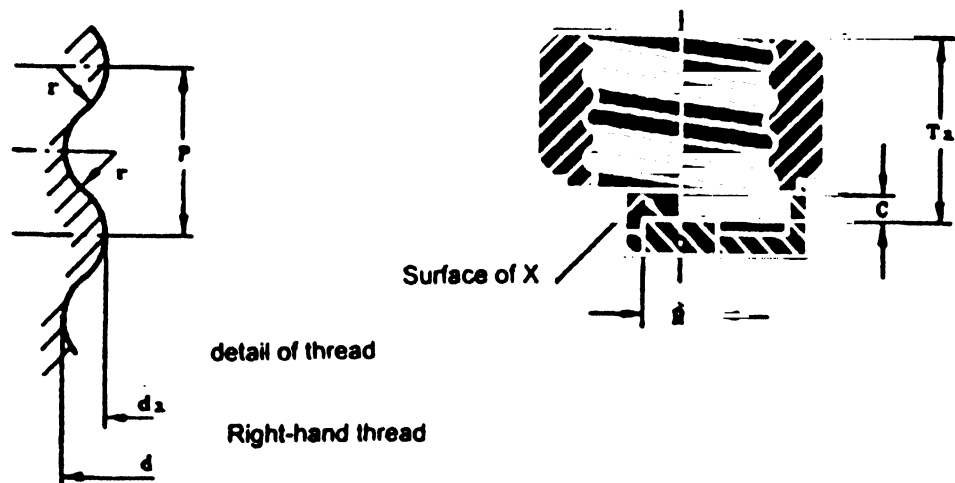
Reference	Dimension	Tolerance
<i>O</i>	12	+0.03 -0.03
<i>S</i>	4.5	+0.01 -0.0
<i>V</i>	1	+0.02 -0.0
<i>d</i>	13.94	+0.03 -0.0
<i>h</i>	7.5	+0.1 -0.1
<i>m</i>	11	+0.1 -0.1

Data Sheet No. 7006-27G

**“GO” GAUGE FOR CAPS ON FINISHED LAMPS
E12**

Dimensions in millimetres.

The drawings are intended only to illustrate the essential dimensions of the gauge.
For details of cap E12 see data sheet 7004-28.



The sharp part of the edge of the thread at the entrance of the gauge shall be broken with a radius of 0.2 to 0.3 mm.

PURPOSE: To check the maximum dimensions of the screw thread and dimension T_1 minimum of E12 caps on finished lamps.

TESTING: When the cap on finished lamps has been screwed into the gauge as far as it will go, the centre contact shall touch surface X . When the lamp is being removed from the gauge, at least two full turns shall be required to disengage the threads.

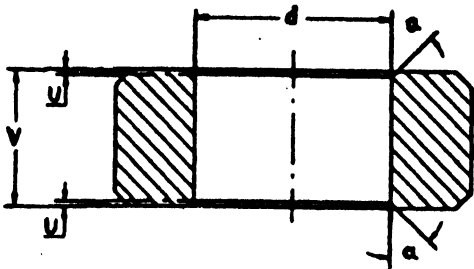
This gauge should be used only in conjunction with the gauge specified on data sheet 7006-27J.

Reference	Dimensions	Tolerance	Limit After Wear
C	1.60	+0.0 -0.025	—
H	4.75	+0.025 -0.025	—
P	2.540	—	—
T_1	11.17	+0.0 -0.025	—
d	11.887	+0.025 -0.0	11.914
d_1	10.617	+0.025 -0.0	10.644
r	0.792	—	—

ADDITIONAL “GO” GAUGE FOR CAPS
ON FINISHED LAMPS
E12

Dimensions in millimetres.

The drawing is intended only to illustrate the essential dimensions of the gauge.
For details of cap E12, see data sheet 7004-28.



PURPOSE: To check the maximum outside (major) diameter, dimension *d*, of E12 caps on finished lamps.
TESTING: The gauge shall pass over the threads of the cap. The maximum force used shall not exceed 4.5 N.
This gauge should be used only in conjunction with the gauge specified on data sheet 7006-27H.

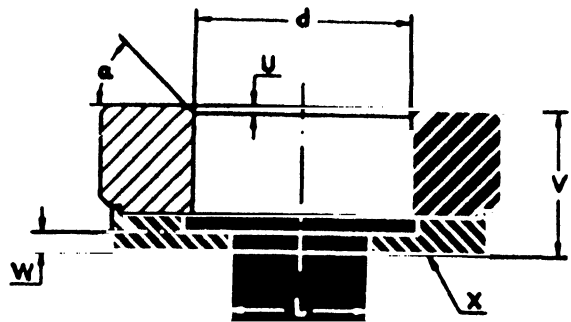
Reference	Dimension	Tolerance	Limit After Wear
<i>U</i>	0.5	+0.1 -0.1	—
<i>V</i>	7	+0.2 -0.2	—
<i>d</i>	11.887	+0.005 -0.0	11.894
<i>α</i>	Approx 45°		

Data Sheet No. 7006-27J

“NOT GO” GAUGE FOR E27 CAPS ON FINISHED LAMPS

Dimensions in millimetres.

The drawing is intended only to illustrate the essential dimensions of the gauge.



PURPOSE: To check the minimum outside (major) diameter of the screw thread, dimension *d* of E27 caps on finished lamps shown on data sheet 7004-21.

TESTING: When the gauge is placed over the thread of the cap on a finished lamp, held cap uppermost, the centre contact shall not project beyond surface *X*.

Only the mass beyond surface *X*.

Reference	Dimensions	Tolerance
<i>d</i>	26.05	+0.0 -0.01
<i>L</i>	16.5	+0.1 -0.1
<i>U</i>	1	+0.0 -0.1
<i>V</i>	17.0	+0.05 -0.0
<i>W</i>	2	+0.1 -0.1
<i>a</i>	Nom 45°	
Mass	0.15 kg	+10% -10%

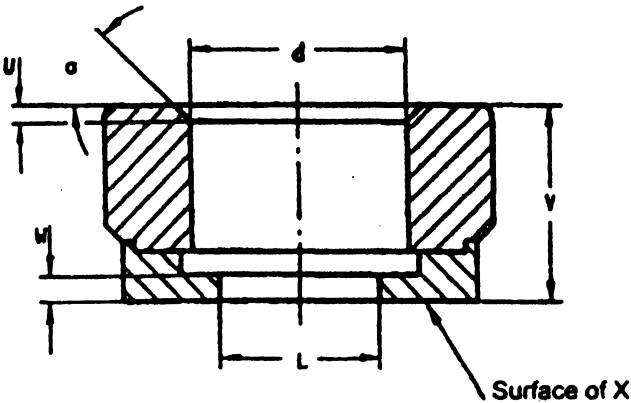
Data Sheet No. 7006-28A

“NOT GO” GAUGE FOR E14 CAPS ON FINISHED LAMPS

Dimensions in millimetres.

The drawing is intended only to illustrate the essential dimensions of the gauge.

For details of caps E14, see data sheet 7004-23.



PURPOSE: To check the minimum outside (major) diameter of the screw thread, dimension *d*, of E14 caps on finished lamps.

TESTING: When the gauge is placed over the thread of the cap on a finished lamp, held cap uppermost, the centre contact shall not project beyond surface *X*.

Only the mass of the gauge itself shall be used in the test.

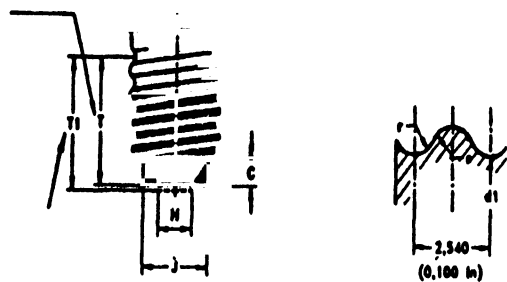
Reference	Dimensions	Tolerance
<i>L</i>	9.5	+0.1 −0.1
<i>U</i>	1	+0.0 −0.1
<i>V</i>	12	+0.05 −0.0
<i>W</i>	1.5	+0.1 −0.1
<i>d</i>	13.60	+0.0 −0.01
<i>α</i>	Approx 45°	
Mass	0.100 kg	+10% −10%

**“NOT GO” GAUGE FOR CAPS ON FINISHED LAMPS
E12**

Dimensions in millimetres.

The drawing is intended only to illustrate the essential dimensions of the gauge.

For details of cap E12, see data sheet 7004-28.



PURPOSE: To check the minimum outside (major) diameter of the screw thread, dimension *d*, of E12 caps on finished lamps.

TESTING: When the gauge is placed over the thread of the cap on a finished lamp, held cap uppermost, the centre contact shall not project beyond surface *X*.

Only the mass of the gauge itself shall be used in the test.

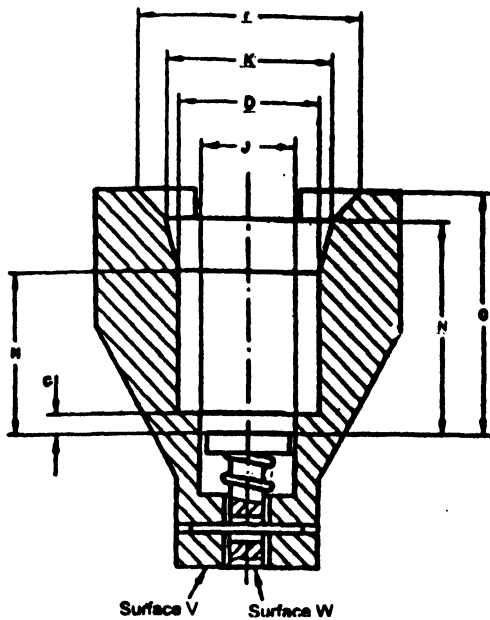
Reference	Dimensions	Tolerance
<i>L</i>	7.5	+0.1 -0.1
<i>P</i>	3.0	+0.5 -0.0
<i>U</i>	1.0	+0.0 -0.1
<i>V</i>	9.5	+0.05 -0.0
<i>W</i>	1.0	+0.1 -0.1
<i>d</i>	11.46	+0.0 -0.01
<i>α</i>	Approx 45°	
Mass	0.116 kg	+10% -10%

GAUGE FOR FINISHED LAMPS FITTED WITH E12 CAPS FOR TESTING CONTACT MAKING

Dimension in millimetres.

The drawing is intended only to illustrate the essential dimensions of the gauge.

For details of cap E12, see data sheet 7004-28.



The plunger of the gauge is shown in the test position.

When the plunger is at rest, surface *W* shall be retracted deeper than surface *V*.

PURPOSE: To check lamp dimensions, particularly the combination of cap length and bulb shoulder shape, for contact-making in a lampholder.

TESTING: The shape of the lamp, with regard to the fit in the lampholder, is assumed to be correct, if the lamp can be pushed into the gauge until surface *W* reaches surface *V* or projects beyond it.

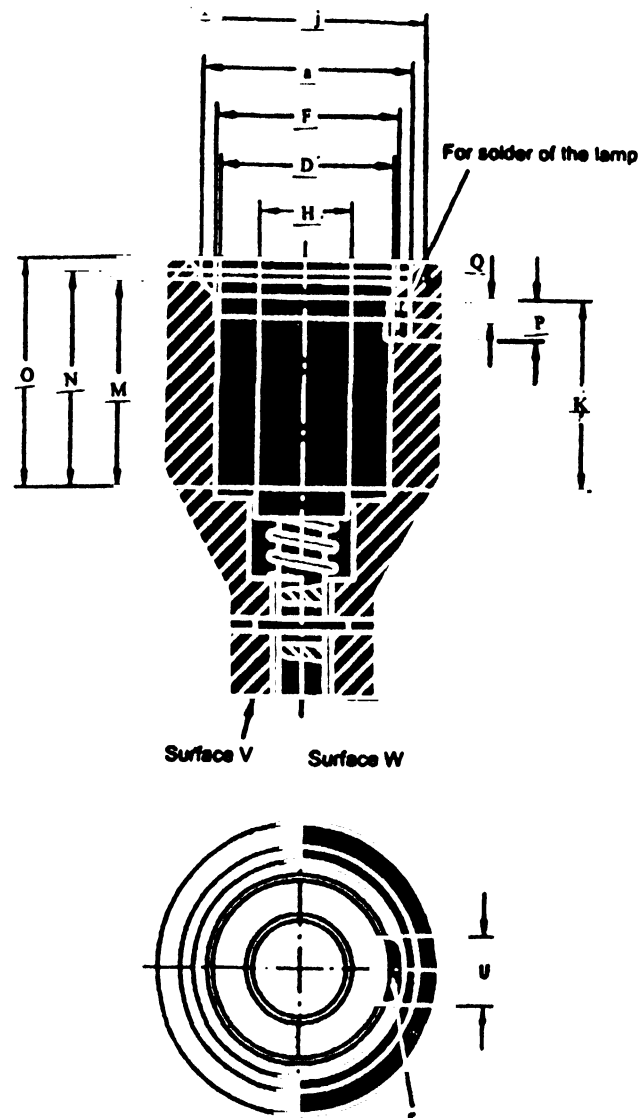
Reference	Dimensions	Tolerance
<i>C</i>	1.60	+0.02 -0.0
<i>D</i>	11.94	+0.0 -0.02
<i>E</i>	14.27	+0.0 -0.02
<i>F</i>	19.05	+0.0 -0.02
<i>J</i>	7.62	+0.02 -0.0
<i>M</i>	13.21	+0.02 -0.0
<i>N</i>	17.45	+0.02 -0.0
<i>O</i>	19.84	+0.02 -0.0

**GAUGE FOR CAPS ON FINISHED LAMP FOR
TESTING PROTECTION AGAINST ACCIDENTAL CONTACT
E27/51 × 39**

Dimension in millimetres.

The drawing is intended only to illustrate the essential dimensions of the gauge.

For details of cap E27/51 × 39, see data sheet 7004-27.



The plunger of the gauge is shown in the test position.

When the plunger is at rest, surface *W* shall be retracted deeper than surface *V*.

PURPOSE: To check protection against accidental contact of caps E27/51 × 39 on finished lamps.

TESTING: The shape of the cap with regard to protection against accidental contact is assumed to be correct if, when the cap is pushed as far as possible into the gauge, surface *W* does not protrude beyond surface *V*.

Data Sheet No. 7006-51

(Continued)

**GAUGE FOR CAPS ON FINISHED LAMP FOR
TESTING PROTECTION AGAINST ACCIDENTAL CONTACT
E27/51 × 39**

Reference	Dimensions	Tolerance
<i>D</i>	26.55	+0.0 −0.02
<i>F</i>	27.2	+0.05 −0.0
<i>G</i>	32	+0.02 −0.0
<i>H</i>	14	+0.1 −0.1
<i>J</i>	36	+0.2 −0.0
<i>K</i>	31.4	+0.0 −0.02
<i>M</i>	33.8	+0.0 −0.02
<i>N</i>	35	+0.0 −0.02
<i>O</i>	37	+0.0 −0.2
<i>P</i>	8	+0.1 −0.1
<i>Q</i>	6	+0.1 −0.1
<i>U</i>	10	+0.1 −0.1
<i>r</i>	2.5	+0.5 −0.0

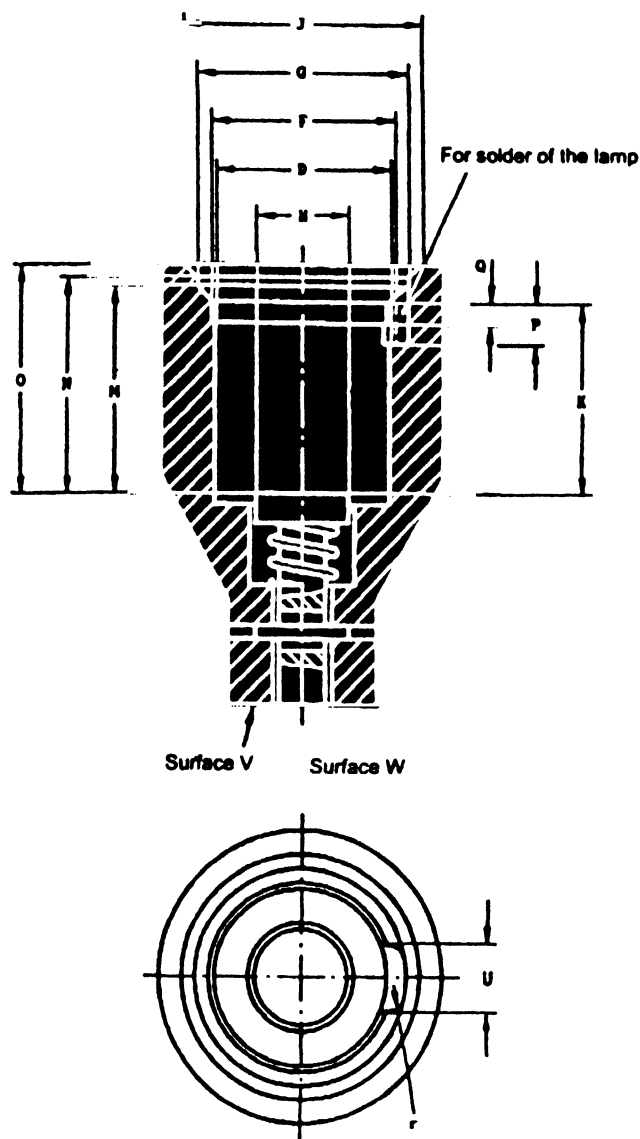
Data Sheet No. 7006-51

**GAUGE FOR CAPS ON FINISHED LAMPS FOR TESTING PROTECTION AGAINST
ACCIDENTAL CONTACT DURING INSERTION
E27**

Dimensions in millimetres.

The drawing is intended only to illustrate the essential dimensions of the gauge.

For details of cap E27 see data sheet 7004-21.



The plunger of the gauge is shown in the test position.

When the plunger is at rest, surface *W* shall be retracted deeper than surface *V*.

PURPOSE: To check protection against accidental contact during insertion of caps E27 on finished lamps.

TESTING: The shape of the lamp with regard to protection against accidental contact is assumed to be correct if, when the lamp is pushed as far as possible into the gauge, surface *W* does not protrude beyond surface *V*.

Data Sheet No. 7006-51A

(Continued)

**GAUGE FOR CAPS ON FINISHED LAMPS FOR TESTING PROTECTION AGAINST
ACCIDENTAL CONTACT DURING INSERTION
E27**

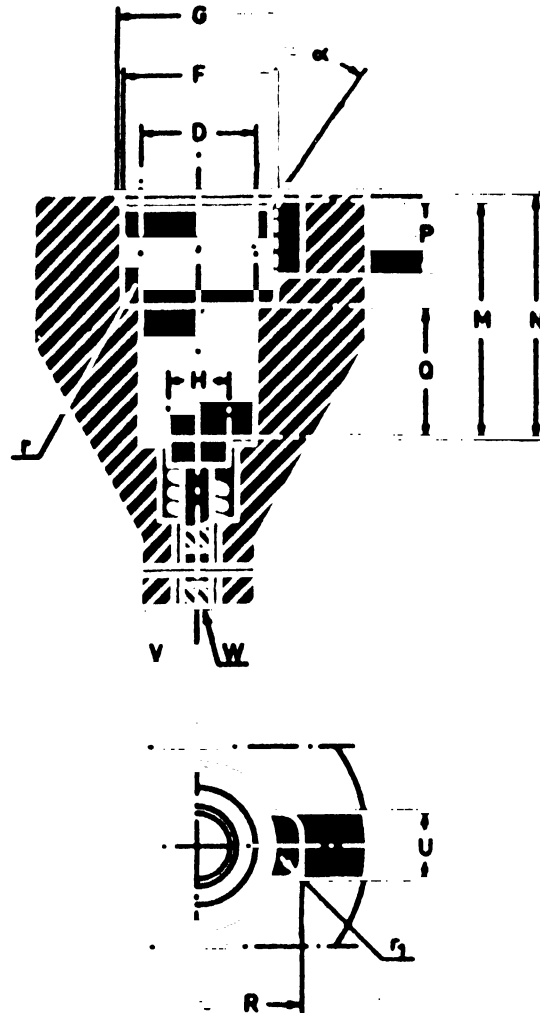
Reference	Dimensions	Tolerance
<i>D</i>	26.55	+0.0 -0.02
<i>F</i>	27.2	+0.05 -0.0
<i>G</i>	32	+0.02 -0.0
<i>H</i>	14	+0.1 -0.1
<i>J</i>	36	+0.2 -0.0
<i>K</i>	28.4	+0.0 -0.02
<i>M</i>	30.8	+0.0 -0.02
<i>N</i>	32	+0.0 -0.02
<i>O</i>	34	+0.0 -0.2
<i>P</i>	6	+0.1 -0.1
<i>Q</i>	3	+0.1 -0.1
<i>U</i>	10	+0.1 -0.1
<i>r</i>	2.5	+0.5 -0.0

Data Sheet No. 7006-51A

GAUGE FOR FINISHED LAMPS FITTED WITH E14 CAPS FOR TESTING PROTECTION AGAINST ACCIDENTAL CONTACT

Dimensions in millimetres.

The drawing is intended only to illustrate the essential dimensions of the gauge.



The gauge is shown in the test position. In the test position the plunger shall be above plane *V*.

PURPOSE: To check protection against accidental contact.

TESTING: The shape of the lamp with regard to protection against accidental contact is assumed to be correct if the test sample being pushed as far as possible into the gauge, plane *W* does not protrude beyond plane *V*.

The application of this gauge is restricted to the following lamps when they are fitted with E14 caps, in accordance with data sheet 7004-23:

- Candle lamps
- Round bulb lamps
- Domestic tubular lamps
- Pygmy lamps.

Data Sheet No. 7006-55

(Continued)

GAUGE FOR FINISHED LAMPS FITTED WITH E14 CAPS FOR TESTING PROTECTION AGAINST ACCIDENTAL CONTACT

Reference	Dimension	Tolerance
<i>D</i>	13.97	+0.02 -0.0
<i>F</i>	18.1	+0.05 0.0
<i>G</i>	19	+0.02 -0.0
<i>H</i>	7.5	+0.1 -0.1
<i>M</i>	27.5	+0.1 -0.1
<i>N</i>	28.5	+0.0 -0.02
<i>P</i>	10	+0.1 -0.1
<i>Q</i>	15	+0.0 -0.1
<i>R</i>	Approx 12.5	
<i>U</i>	8	+0.1 -0.1
<i>r</i>	< 0.5	
<i>r₁</i>	2.5	+0.5 -0.0
α	35°	+30° -30°

Data Sheet No. 7006-55

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Amendments Issued Since Publication

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